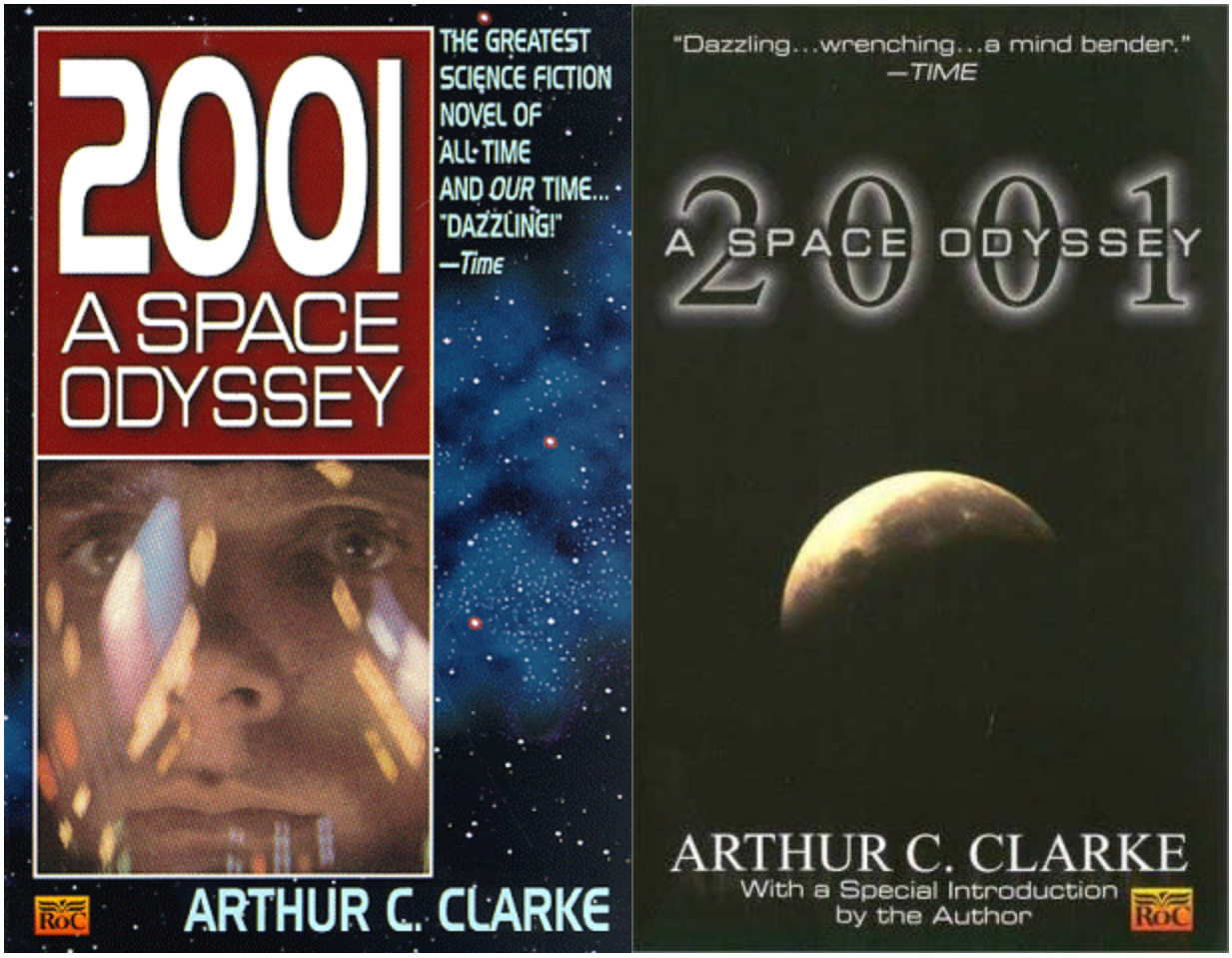

2001: A Space Odyssey

Arthur C. Clarke

Foreword

Behind every man now alive stand thirty ghosts, for that is the ratio by which the dead outnumber the living. Since the dawn of time, roughly a hundred billion human beings have walked the planet Earth.

Now this is an interesting number, for by a curious coincidence there are approximately a hundred billion stars in our local universe, the Milky Way. So for every man who has ever lived, in this Universe there shines a star.

But every one of those stars is a sun, often far more brilliant and glorious than the small, nearby star we call the Sun. And many - perhaps most - of those alien suns have planets circling them. So almost certainly there is enough land

in the sky to give every member of the human species, back to the first ape-man, his own private, world-sized heaven - or hell.

How many of those potential heavens and hells are now inhabited, and by what manner of creatures, we have no way of guessing; the very nearest is a million times farther away than Mars or Venus, those still remote goals of the next generation. But the barriers of distance are crumbling; one day we shall meet our equals, or our masters, among the stars.

Men have been slow to face this prospect; some still hope that it may never become reality. Increasing numbers, however, are asking: "Why have such meetings not occurred already, since we ourselves are about to venture into space?"

Why not, indeed? Here is one possible answer to that very reasonable question. But please remember this is only a work of fiction.

The truth, as always, will be far stranger.

To Stanley

I - PRIMEVAL NIGHT

1 - The Road to Extinction

The drought had lasted now for ten million years, and the reign of the terrible lizards had long since ended. Here on the Equator, in the continent which would one day be known as Africa, the battle for existence had reached a new climax of ferocity, and the victor was not yet in sight. In this barren and desiccated land, only the small or the swift or the fierce could flourish, or even hope to survive.

The man-apes of the veldt were none of these things, and they were not flourishing. Indeed, they were already far down the road to racial extinction. About fifty of them occupied a group of caves overlooking a small, parched valley, which was divided by a sluggish stream fed from snows in the mountains two hundred miles to the north. In bad times the stream vanished completely, and the tribe lived in the shadow of thirst.

It was always hungry, and now it was starving. When the first faint glow of dawn crept into the cave, Moon-Watcher saw that his father had died in the night. He did not know that the Old One was his father, for such a relationship was utterly beyond his understanding, but as he looked at the emaciated body he felt dim disquiet that was the ancestor of sadness.

The two babies were already whimpering for food, but became silent when Moon-Watcher snarled at them. One of the mothers, defending the infant she could

not properly feed, gave him an angry growl in return; he lacked the energy even to cuff her for her presumption.

Now it was light enough to leave. Moon-Watcher picked up the shriveled corpse and dragged it after him as he bent under the low overhang of the cave. Once outside, he threw the body over his shoulder and stood upright - the only animal in all this world able to do so.

Among his kind, Moon-Watcher was almost a giant. He was nearly five feet high, and though badly undernourished weighed over a hundred pounds. His hairy, muscular body was halfway between ape and man, but his head was already much nearer to man than ape. The forehead was low, and there were ridges over the eye sockets, yet he unmistakably held in his genes the promise of humanity. As he looked out upon the hostile world of the Pleistocene, there was already something in his gaze beyond the capacity of any ape. In those dark, deep-set eyes was a dawning awareness - the first intimations of an intelligence that could not possibly fulfill itself for ages yet, and might soon be extinguished forever.

There was no sign of danger, so Moon-Watcher began to scramble down the almost vertical slope outside the cave, only slightly hindered by his burden. As if they had been waiting for his signal, the rest of the tribe emerged from their own homes farther down the rock face, and began to hasten toward the muddy waters of the stream for their morning drink.

Moon-Watcher looked across the valley to see if the Others were in sight, but there was no trace of them. Perhaps they had not yet left their caves, or were already foraging farther along the hillside. Since they were nowhere to be seen, Moon-Watcher forgot them; he was incapable of worrying about more than one thing at a time.

First he must get rid of the Old One, but this was a problem that demanded little thought. There had been many deaths this season, one of them in his own cave; he had only to put the corpse where he had left the new baby at the last quarter of the moon, and the hyenas would do the rest.

They were already waiting, where the little valley fanned out into the savanna, almost as if they had known that he was coming. Moon-Watcher left the body under a small bush - all the earlier bones were already gone - and hurried back to rejoin the tribe. He never thought of his father again.

His two mates, the adults from the other caves, and most of the youngsters were foraging among the drought-stunted trees farther up the valley, looking for berries, succulent roots and leaves, and occasional windfalls like small lizards or rodents. Only the babies and the feeblest of the old folk were left in the caves; if there was any surplus food at the end of the day's searching, they might be fed. If not, the hyenas would soon be in luck once more.

But this day was a good one - though as Moon-Watcher had no real remembrance of the past, he could not compare one time with another. He had found a hive of bees in the stump of a dead tree, and so had enjoyed the finest delicacy that his people could ever know; he still licked his fingers from time to time as he led the group homeward in the late afternoon. Of course, he had also collected a fair number of stings, but he had scarcely noticed them. He was now as near to contentment as he was ever likely to be; for though he was still hungry, he was not actually weak with hunger. That was the most to which any man-ape could ever aspire.

His contentment vanished when he reached the stream. The Others were there. They were there every day, but that did not make it any the less annoying.

There were about thirty of them, and they could not have been distinguished from the members of MoonWatcher's own tribe. As they saw him coming they begun to dance, shake their arms, and shriek on their side of the stream, and his own people replied in kind.

And that was all that happened. Though the man-apes often fought and wrestled one another, their disputes very seldom resulted in serious injuries. Having no claws or fighting canine teeth, and being well protected by hair, they could not inflict much harm on one another. In any event, they had little surplus energy for such unproductive behavior; snarling and threatening was a much more efficient way of asserting their points of view.

The confrontation lasted about five minutes; then the display died out as quickly as it had begun, and everyone drank his fill of the muddy water. Honor had been satisfied; each group had staked its claim to its own territory. This important business having been settled, the tribe moved off along its side of the river. The nearest worthwhile grazing was now more than a mile from the caves, and they had to share it with a herd of large, antelope-like beasts who barely tolerated their presence. They could not be driven away, for they were armed with ferocious daggers on their foreheads - the natural weapons which the man-apes did not possess.

So Moon-Watcher and his companions chewed berries and fruit and leaves and fought off the pangs of hunger - while all around them, competing for the same fodder, was a potential source of more food than they could ever hope to eat. Yet the thousands of tons of succulent meat roaming over the savanna and through the bush was not only beyond their reach; it was beyond their imagination. In the midst of plenty, they were slowly starving to death.

The tribe returned to its cave without incident, in the last light of the day. The injured female who had remained behind cooed with pleasure as Moon-Watcher gave her the berry-covered branch he had brought back, and began to attack it ravenously. There was little enough nourishment here, but it would help her to survive until the wound the leopard had given her had healed, and she could forage for herself again.

Over the valley, a full moon was rising, and a chill wind was blowing down from the distant mountains. It would be very cold tonight - but cold, like hunger, was not a matter for any real concern; it was merely part of the background of life.

Moon-Watcher barely stirred when the shrieks and screams echoed up the slope from one of the lower caves, and he did not need to hear the occasional growl of the leopard to know exactly what was happening.

Down there in the darkness old White Hair and his family were fighting and dying, and the thought that he might help in some way never crossed Moon-Watcher's mind. The harsh logic of survival ruled out such fancies, and not a voice was raised in protest from the listening hillside. Every cave was silent, lest it also attract disaster.

The tumult died away, and presently Moon-Watcher could hear the sound of a body being dragged over rocks. That lasted only a few seconds; then the leopard

got a good hold on its kill. It made no further noise as it padded silently away, carrying its victim effortlessly in its jaws.

For a day or two, there would be no further danger here, but there might be other enemies abroad, taking advantage of this cold Little Sun that shone only by night. If there was sufficient warning, the smaller predators could sometimes be scared away by shouts and screams. Moon-Watcher crawled out of the cave, clambered onto a large boulder beside the entrance, and squatted there to survey the valley.

Of all the creatures who had yet walked on Earth, the man-apes were the first to look steadfastly at the Moon. And though he could not remember it, when he was very young Moon-Watcher would sometimes reach out and try to touch that ghostly face rising above the hills.

He had never succeeded, and now he was old enough to understand why. For first, of course, he must find a high enough tree to climb.

Sometimes he watched the valley, and sometimes he watched the Moon, but always he listened. Once or twice he dozed off, but he slept with a hair-trigger alertness, and the slightest sound would have disturbed him. At the great age of twenty-five, he was still in full possession of all his faculties; if his luck continued, and he avoided accidents, disease, predators, and starvation, he might survive for as much as another ten years.

The night wore on, cold and clear, without further alarms, and the Moon rose slowly amid equatorial constellations that no human eye would ever see. In the caves, between spells of fitful dozing and fearful waiting, were being born the nightmares of generations yet to be.

And twice there passed slowly across the sky, rising up to the zenith and descending into the east, a dazzling point of light more brilliant than any star.

2 - The New Rock

Late that night, Moon-Watcher suddenly awoke. Tired out by the day's exertions and disasters, he had been sleeping more soundly than usual, yet he was instantly alert at the first faint scrabbling down in the valley.

He sat up in the fetid darkness of the cave, straining his senses out into the night, and fear crept slowly into his soul. Never in his life - already twice as long as most members of his species could expect - had he heard a sound like this. The great cats approached in silence, and the only thing that betrayed them was a rare slide of earth, or the occasional cracking of a twig. Yet this was a continuous crunching noise, that grew steadily louder. It seemed that some enormous beast was moving through the night, making no attempt at concealment, and ignoring all obstacles. Once Moon-Watcher heard the unmistakable sound of a bush, being uprooted; the elephants and dinotheria did this often enough, but otherwise they moved as silently as the cats.

And then there came a sound which Moon-Watcher could not possibly have identified, for it had never been heard before in the history of the world. It was the clank of metal upon stone.

Moon-Watcher came face to face with the New Rock when he led the tribe down to the river in the first light of morning. He had almost forgotten the terrors of the night, because nothing had happened after that initial noise, so he did not even associate this strange thing with danger or with fear. There was, after all, nothing in the least alarming about it.

It was a rectangular slab, three times his height but narrow enough to span with his arms, and it was made of some completely transparent material; indeed, it was not easy to see except when the rising sun glinted on its edges. As Moon-Watcher had never encountered ice, or even crystal-clear water, there were no natural objects to which he could compare this apparition. It was certainly rather attractive, and though he was wisely cautious of most new things, he did not hesitate for long before sidling up to it. As nothing happened, he put out his hand, and felt a cold, hard surface.

After several minutes of intense thought, he arrived at a brilliant explanation. It was a rock, of course, and it must have grown during the night. There were many plants that did this - white, pulpy things shaped like pebbles, that seemed to shoot up during the hours of darkness. It was true that they were small and round, whereas this was large and sharp-edged; but greater and later philosophers than Moon-Watcher would be prepared to overlook equally striking exceptions to their theories.

This really superb piece of abstract thinking led Moon-Watcher, after only three or four minutes, to a deduction which he immediately put to the test. The white round pebble-plants were very tasty (though there were a few that produced violent illness); perhaps this tall one...?

A few licks and attempted nibbles quickly disillusioned him. There was no nourishment here; so like a sensible man-ape, he continued on his way to the river and forgot all about the crystalline monolith, during the daily routine of shrieking at the Others.

The foraging today was very bad, and the tribe had to travel several miles from the caves to find any food at all. During the merciless heat of noon one of the frailer females collapsed, far from any possible shelter. Her companions gathered round her, twittering and meeping sympathetically, but there was nothing that anyone could do. If they had been less exhausted they might have carried her with them, but there was no surplus energy for such acts of kindness. She had to be left behind, to recover or not with her own resources. They passed the spot on the homeward trek that evening; there was not a bone to be seen.

In the last light of day, looking round anxiously for early hunters, they drank hastily at the stream and started the climb up to their caves. They were still a hundred yards from the New Rock when the sound began.

It was barely audible, yet it stopped them dead, so that they stood paralyzed on the trail with their jaws hanging slackly. A simple, maddeningly repetitious vibration, it pulsed out from the crystal; and hypnotized all who came within its spell. For the first time - and the last, for three million years - the sound of drumming was heard in Africa.

The throbbing grew louder, more insistent. Presently the man-apes began to move forward, like sleepwalkers, toward the source of that compulsive sound. Sometimes they took little dancing steps, as their blood responded to rhythms that their descendants would not create for ages yet. Totally entranced, they gathered round the monolith, forgetting the hardships of the day, the perils of the approaching dusk, and the hunger in their bellies.

The drumming became louder, the night darker. And as the shadows lengthened and the light drained from the sky, the crystal began to glow.

First it lost its transparency, and became suffused with a pale, milky luminescence, Tantalizing, ill-defined phantoms moved across its surface and in its depths. They coalesced into bars of light and shadow, then formed intermeshing, spoked patterns that began slowly to rotate.

Faster and faster spun the wheels of light, and the throbbing of the drums accelerated with them. Now utterly hypnotized, the man-apes could only stare slack-jawed into this astonishing display of pyrotechnics. They had already forgotten the instincts of their forefathers and the lessons of a lifetime; not one of them, ordinarily, would have been so far from his cave, so late in the evening. For the surrounding brush was full of frozen shapes and staring eyes, as the creatures of the night suspended their business to see what would happen next.

Now the spinning wheels of light began to merge, and the spokes fused into luminous bars that slowly receded into the distance, rotating on their axes as they did so. They split into pairs and the resulting sets of lines started to oscillate across one another, slowly changing their angles of intersection. Fantastic, fleeting geometrical patterns flickered in and out of existence as the glowing grids meshed and unmeshed; and the man-apes watched, mesmerized captives of the shining crystal.

They could never guess that their minds were being probed, their bodies mapped, their reactions studied, their potentials evaluated. At first, the whole tribe remained half crouching in a motionless tableau, as if frozen into stone. Then the man-ape nearest to the slab suddenly came to life.

He did not move from his position, but his body lost its trancelike rigidity and became animated as if it were a puppet controlled by invisible strings. The head turned this way and that; the mouth silently opened and closed; the hands clenched and unclenched. Then he bent down, snapped off a long stalk of grass, and attempted to tie it into a knot with clumsy fingers.

He seemed to be a thing possessed, struggling against some spirit or demon who had taken over control of his body. He was panting for breath, and his eyes were full of terror as he tried to force his fingers to make movements more complex than any that they had ever attempted before.

Despite all his efforts, he succeeded only in breaking the stalk into pieces. As the fragments fell to the ground, the controlling influence left him, and he froze once more into immobility.

Another man-ape came to life, and went through the same routine. This was a younger, more adaptable specimen; it succeeded where the older one had failed. On the planet Earth, the first crude knot had been tied.

Others did stranger and still more pointless things. Some held their hands out at arm's length, and tried to touch their fingertips together - first with both eyes open, then with one closed. Some were made to stare at ruled patterns in the crystal, which became more and more finely divided until the lines had merged into a gray blur. And all heard single pure sounds, of varying pitch, that swiftly sank below the level of hearing.

When Moon-Watcher's turn came, he felt very little fear. His main sensation was a dull resentment, as his muscles twitched and his limbs moved at commands that were not wholly his own. Without knowing why, he bent down and picked up a small stone. When he straightened up, he saw that there was a new image in the crystal slab.

The grids and the moving, dancing patterns had gone. Instead, there was a series of concentric circles, surrounding a small black disk. Obeying the silent orders in his brain, he pitched the stone with a clumsy, overarm throw. It missed the target by several feet.

Try again, said the command. He searched around until he had found another pebble. This time it hit the slab with a ringing, bell-like tone. He was still a long way off, but his aim was improving. At the fourth attempt, he was only inches from the central bull's-eye. A feeling of indescribable pleasure, almost sexual in its intensity, flooded his mind. Then the control relaxed; he felt no impulse to do anything, except to stand and wait.

One by one, every member of the tribe was briefly possessed. Some succeeded, but most failed at the tasks they had been set, and all were appropriately rewarded by spasms of pleasure or of pain.

Now there was only a uniform featureless glow in the great slab, so that it stood like a block of light superimposed oil the surrounding darkness. As if waking from a sleep, the man-apes shook their heads, and presently began to move along the trail to their place of shelter. They did not look back, or wonder at the strange light that was guiding them to their homes - and to a future unknown, as yet, even to the stars.

3 - Academy

Moon-Watcher and his companions had no recollection of what they had seen, after the crystal had ceased to cast its hypnotic spell over their minds and to experiment with their bodies. The next day, as they went out to forage, they passed it with scarcely a second thought; it was now part of the disregarded background of their lives. They could not eat it, and it could not eat them; therefore it was not important.

Down at the river, the Others made their usual ineffectual threats. Their leader, a one-eared man-ape of Moon-Watcher's size and age, but in poorer condition, even made a brief foray toward the tribe's territory, screaming loudly and waving his arms in an attempt to scare the opposition and to bolster his own courage.

The water of the stream was nowhere more than a foot deep, but the farther One-Ear moved out into it, the more uncertain and unhappy he became. Very soon

he slowed to a halt, and then moved back, with exaggerated dignity, to join his companions.

Otherwise, there was no change in the normal routine. The tribe gathered just enough nourishment to survive for another day, and no one died.

And that night, the crystal slab was still waiting; surrounded by its pulsing aura of light and sound. The program it had contrived, however, was now subtly different.

Some, of the man-apes it ignored completely, as if it was concentrating on the most promising subjects.

One of them was Moon-Watcher; once again he felt inquisitive tendrils creeping down the unused byways of his brain. And presently, he began to see visions. They might have been within the crystal block; they might have been wholly inside his mind. In any event, to Moon-Watcher they were completely real. Yet somehow the usual automatic impulse to drive off invaders of his territory had been lulled into quiescence.

He was looking at a peaceful family group, differing in only one respect from the scenes he knew. The male, female, and two infants that had mysteriously appeared before him were gorged and replete, with sleek and glossy pelts - and this was a condition of life that Moon-Watcher had never imagined. Unconsciously, he felt his own protruding ribs; the ribs of these creatures were hidden in rolls of fat. From time to time they stirred lazily, as they lolled at ease near the entrance of a cave, apparently at peace with the world. Occasionally; the big male emitted a monumental burp of contentment.

There was no other activity, and after five minutes the scene suddenly faded out. The crystal was no more than a glimmering outline in the darkness; Moon-Watcher shook himself as if awaking from a dream, abruptly realized where he was, and led the tribe back to the caves.

He had no conscious memory of what he had seen; but that night, as he sat brooding at the entrance of his lair, his ears attuned to the noises of the world around him, Moon-Watcher felt the first faint twinges of a new and potent emotion. It was a vague and diffuse sense of envy - of dissatisfaction with his life. He had no idea of its cause, still less of its cure; but discontent had come into his soul, and he had taken one small step toward humanity.

Night after night, the spectacle of those four plump man-apes was repeated, until it had become a source of fascinated exasperation, serving to increase Moon-Watcher's eternal, gnawing hunger. The evidence of his eyes could not have produced this effect; it needed psychological reinforcement. There were gaps in Moon-Watcher's life now that he would never remember, when the very atoms of his simple brain were being twisted into new patterns. If he survived, those patterns would become eternal, for his genes would pass them on to future generations.

It was a slow, tedious business, but the crystal monolith was patient. Neither it, nor its replicas scattered across half the globe, expected to succeed with all the scores of groups involved in the experiment. A hundred failures would not matter, when a single success could change the destiny of the world.

By the time of the next new moon, the tribe had seen one birth and two deaths. One of these had been due to starvation; the other had occurred during the nightly ritual, when a man-ape had suddenly collapsed while attempting to tap two pieces of stone delicately together. At once, the crystal had darkened, and the tribe had been released from the spell. But the fallen man-ape had not moved; and by the morning, of course, the body was gone.

There had been no performance the next night; the crystal was still analyzing its mistake. The tribe streamed past it through the gathering dusk, ignoring its presence completely. The night after, it was ready for them again. The four plump man-apes were still there, and now they were doing extraordinary things. Moon-Watcher began to tremble uncontrollably; he felt as if his brain would burst, and wanted to turn away his eyes. But that remorseless mental control would not relax its grip; he was compelled to follow the lesson to the end, though all his instincts revolted against it.

Those instincts had served his ancestors well, in the days of warm rains and lush fertility, when food was to be had everywhere for the plucking. Now times had changed, and the inherited wisdom of the past had become folly. The man-apes must adapt, or they must die - like the greater beasts who had gone before them, and whose bones now lay sealed within the limestone hills.

So Moon-Watcher stared at the crystal monolith with unblinking eyes, while his brain lay open to its still uncertain manipulations. Often he felt nausea, but always he felt hunger; and from time to time his hands clenched unconsciously in the patterns that would determine his new way of life.

As the line of warthogs moved snuffling and grunting across the trail, Moon-Watcher came to a sudden halt. Pigs and man-apes had always ignored each other, for there was no conflict of interest between them. Like most animals that did not compete for the same food, they merely kept out of each other's way.

Yet now Moon-Watcher stood looking at them, wavering back and forth uncertainly as he was buffeted by impulses which he could not understand, Then, as if in a dream, he started searching the ground - though for what, he could not have explained even if he had had the power of speech. He would recognize it when he saw it.

It was a heavy, pointed stone about six inches long, and though it did not fit his hand perfectly, it would do. As he swung his hand around, puzzled by its suddenly increased weight, he felt a pleasing sense of power and authority. He started to move toward the nearest pig.

It was a young and foolish animal, even by the undemanding standards of warthog intelligence. Though it observed him out of the corner of its eye, it did not take him seriously until much too late. Why should it suspect these harmless creatures of any evil intent? It went on rooting up the grass until Moon-Watcher's stone hammer obliterated its dim consciousness. The remainder of the herd continued grazing unalarmed, for the murder had been swift and silent.

All the other man-apes in the group had stopped to watch, and now they crowded round Moon-Watcher and his victim with admiring wonder. Presently one of them picked up the blood-stained weapon, and began to pound the dead pig. Others joined in with any sticks and stones that they could gather, until theirt target began a messy disintegration.

Then they became bored; some wandered off, while others stood hesitantly around the unrecognizable corpse - the future of a world waiting upon their decision. It was a surprisingly long time before one of the nursing females began to lick the gory stone she was holding in her paws.

And it was longer still before Moon-Watcher, despite all that he had been shown, really understood that he need never be hungry again.

4 - The Leopard

The tools they had been programmed to use were simple enough, yet they could change this world and make the man-apes its masters. The most primitive was the hand-held stone, that multiplied manyfold the power of a blow. Then there was the bone club, that lengthened the reach and could provide a buffer against the fangs or claws of angry animals. With these weapons, the limitless food that roamed the savannas was theirs to take.

But they needed other aids, for their teeth and nails could not readily dismember anything larger than a rabbit, Luckily, Nature had provided the perfect tools, requiring only the wit to pick them up; First there was a crude but very efficient knife or saw, of a model that would serve well for the next three million years. It was simply the lower jawbone of an antelope, with the teeth still in place; there would be no substantial improvement until the coming of steel. Then there was an awl or dagger in the form of a gazelle horn, and finally a scraping tool made from the complete jaw of almost any small animal.

The stone club, the toothed saw, the horn dagger, the bone scraper - these were the marvelous inventions which the man-apes needed in order to survive. Soon they would recognize them for the symbols of power that they were, but many months must pass before their clumsy fingers had acquired the skill - or the will - to use them.

Perhaps, given time, they might by their own efforts have come to the awesome and brilliant concept of using natural weapons as artificial tools. But the odds were all against them, and even now there were endless opportunities for failure in the ages that lay ahead.

The man-apes had been given their first chance. There would be no second one; the future was, very literally, in their own hands.

Moons waxed and waned; babies were born and sometimes lived; feeble, toothless thirty-year-olds died; the leopard took its toll in the night; the Others threatened daily across the river - and the tribe prospered. In the course of a single year, Moon-Watcher and his companions had changed almost beyond recognition.

They had learned their lessons well; now they could handle all the tools that had been revealed to them. The very memory of hunger was fading from their minds; and though the warthogs were becoming shy, there were gazelles and

antelopes and zebras in countless thousands on the plains. All these animals, and others, had fallen prey to the apprentice hunters.

Now that they were no longer half-numbed with starvation, they had time both for leisure and for the first rudiments of thought. Their new way of life was now casually accepted, and they did not associate it in any way with the monolith still standing beside the trail to the river. If they had ever stopped to consider the matter, they might have boasted that they had brought about their improved status by their own efforts; in fact, they had already forgotten any other mode of existence.

But no Utopia is perfect, and this one had two blemishes. The first was the marauding leopard, whose passion for man-apes seemed to have grown even stronger now that they were better nourished. The second was the tribe across the river; for somehow the Others had survived, and had stubbornly refused to die of starvation.

The leopard problem was resolved partly by chance, partly owing to a serious - indeed almost fatal - error on Moon-Watcher's part. Yet at the time his idea had seemed such a brilliant one that he had danced with joy, and perhaps he could hardly be blamed for overlooking the consequences.

The tribe still experienced occasional bad days, though these no longer threatened its very survival. Toward dusk, it had failed to make a kill; the home caves were already in sight as Moon-Watcher led his tired and disgruntled companions back to shelter. And there, on their very threshold, they found one of nature's rare bonanzas. A full-grown antelope was lying by the trail. Its foreleg was broken, but it still had plenty of fight in it, and the circling jackals gave its daggerlike horns a respectful berth. They could afford to wait; they knew that they had only to bide their time. But they had forgotten about the competition, and retreated with angry snarls when the man-apes arrived.

They too circled warily, keeping beyond the range of those dangerous horns; then they moved to the attack with clubs and stones.

It was not a very effective or coordinated attack; by the time the wretched beast had been given its quietus the light had almost gone - and the jackals were regaining their courage. Moon-Watcher, torn between fear and hunger, slowly realized that all this effort might have been in vain. It was too dangerous to stay here any longer.

Then, not for the first or the last time, he proved himself a genius. With an immense effort of imagination, he visualized the dead antelope - in the safety of his own cave. He began to drag it toward the cliff face; presently, the others understood his intentions, and began to help him.

If he had known how difficult the task would be, he would never have attempted it. Only his great strength, and the agility inherited from his arboreal ancestors allowed him to haul the carcass up the steep slope. Several times, weeping with frustration, he almost abandoned his prize, but a stubbornness as deep-seated as his hunger drove him on. Sometimes the others helped him, sometimes they hindered; more often, they merely got in the way. But finally it was done; the battered antelope was dragged over the lip of the cave, as the last hues of sunlight faded from the sky; and the feasting began.

Hours later, gorged to repletion, Moon-Watcher awoke. Not knowing why, he sat up in the darkness among the sprawled bodies of his equally satiated companions, and strained his ears into the night.

There was no sound except the heavy breathing around him; the whole world seemed asleep. The rocks beyond the mouth of the cave were pale as bone in the brilliant light from the moon, now high overhead. Any thought of danger seemed infinitely remote.

Then, from a long way off, came the sound of a falling pebble. Fearful, yet inquisitive, Moon-Watcher crawled out onto the ledge of the cave and peered down the face of the cliff.

What he saw left him so paralyzed with fright that for long seconds he was unable to move. Only twenty feet below, two gleaming golden eyes were staring straight up at him; they held him so hypnotized with fear that he was scarcely aware of the lithe, streaked body behind them, flowing smoothly and silently from rock to rock. Never before had the leopard climbed so high. It had ignored the lower caves, though it must have been well aware of their inhabitants. Now it was after other game; it was following the spoor of blood, up the moon-washed face of the cliff.

Seconds later, the night was made hideous by the shrieks of alarm from the man-apes in the cave above. The leopard gave a snarl of fury as it realized that it had lost the element of surprise. But it did not check its advance, for it knew that it had nothing to fear.

It reached the ledge, and rested for a moment on the narrow open space. The scent of blood was all around, filling its fierce and tiny mind with one overwhelming desire. Without hesitation, it padded silently into the cave.

And here it made its first error, for as it moved out of the moonlight even its superbly night-adapted eyes were at a momentary disadvantage. The man-apes could see it, partly silhouetted against the opening of the cave, more clearly than it could see them. They were terrified, but they were no longer utterly helpless.

Snarling and lashing its tail in arrogant confidence, the leopard advanced in search of the tender food that it craved. Had it met its prey in the open, it would have had no problems; but now that the man-apes were trapped, desperation had given them the courage to attempt the impossible. And for the first time they had the means to achieve it.

The leopard knew that something was wrong when it felt a stunning blow on its head. It lashed out with its forepaw, and heard a shriek of agony as its claws slashed through soft flesh. Then there was a piercing pain as something sharp drove into its flanks - once, twice, and yet a third time. It whirled around to strike at the shadows screaming and dancing on all sides.

Again there was a violent blow as something caught it across the snout. Its teeth snapped on a white, moving blur - only to grate uselesssly upon dead bone. And now - in a final, unbelievable indignity - its tail was being dragged out by the roots.

It whirled around, throwing its insanely daring tormentor against the wall of the cave. Yet whatever it did, it could not escape the rain of blows, inflicted on it by crude weapons wielded by clumsy but powerful hands. Its

snarls ran the gamut from pain to alarm, from alarm to outright terror. The implacable hunter was now the victim, and was desperately trying to retreat.

And then it made its second mistake, for in its surprise and fright it had forgotten where it was. Or perhaps it had been dazed or blinded by the blows rained on its head; whatever the case, it bolted abruptly from the cave. There was a horrible screech as it went toppling out into space. Ages later, it seemed, there came a thud as it crashed into an outcropping halfway down the cliff; thereafter, the only sound was the sliding of loose stones, which quickly died away into the night.

For a long time, intoxicated by victory, Moon-Watcher stood dancing and gibbering at the entrance of the cave. He rightly sensed that his whole world had changed and that he was no longer a powerless victim of the forces around him.

Then he went back into the cave and, for the first time in his life, had an unbroken night's sleep.

In the morning, they I found the body of the leopard at the foot of the cliff. Even in death, it was some time before anyone dared to approach the vanquished monster, but presently they closed in upon it, with their bone knives and saws.

It was very hard work, and they did no hunting that day.

5 - Encounter in the Dawn

As he led the tribe down to the river in the dim light of dawn, Moon-Watcher paused uncertainly at a familiar spot. Something, he knew, was missing; but what it was, he could not remember. He wasted no mental effort on the problem, for this morning he had more important matters on his mind.

Like thunder and lightning and clouds and eclipses, the great block of crystal had departed as mysteriously as it had come. Having vanished into the nonexistent past, it never troubled Moon-Watcher's thoughts again.

He would never know what it had done to him; and none of his companions wondered, as they gathered round him in the morning mist, why he had paused for a moment here on the way to the river.

From their side of the stream, in the never-violated safety of their own territory, the Others first saw Moon-Watcher and a dozen males of his tribe as a moving frieze against the dawn sky. At once they began to scream their daily challenge; but this time, there was no answer.

Steadily, purposefully - above all, silently - Moon-Watcher and his band descended the low hillock that overlooked the river; and as they approached, the Others became suddenly quiet. Their ritual rage ebbed away, to be replaced by a

mounting fear. They were dimly aware that something had happened, and that this encounter was unlike all those that had ever gone before.

The bone clubs and knives that Moon-Watcher's group carried did not alarm them, for they did not understand their purpose. They only knew that their rivals' movements were now imbued with determination, and with menace.

The party stopped at the water's edge, and for a moment the Others' courage revived. Led by One-Ear, they halfheartedly resumed their battle chant. It lasted only a few seconds before a vision of terror struck then dumb.

Moon-Watcher raised his arms high into the air, revealing the burden that until now had been concealed by the hirsute bodies of his companions. He was holding a stout branch, and impaled upon it was the bloody head of the leopard. The mouth had been jammed open with a stick, and the great fangs gleamed a ghastly white in the first rays of the rising sun.

Most of the Others were too paralyzed with fright to move; but some began a slow, stumbling retreat. That was all the encouragement that Moon-Watcher needed. Still holding the mangled trophy above his head, he started to cross the stream. After a moment's hesitation, his companions splashed after him.

When Moon-Watcher reached the far side, One-Ear was still standing his ground. Perhaps he was too brave or too stupid to run; perhaps he could not really believe that this outrage was actually happening. Coward or hero, it made no difference in the end, as the frozen snarl of death came crashing down upon his uncomprehending head.

Shrieking with fright, the Others scattered into the bush; but presently they would return, and soon they would forget their lost leader.

For a few seconds Moon-Watcher stood uncertainly above his new victim, trying to grasp the strange and wonderful fact that the dead leopard could kill again. Now he was master of the world, and he was not quite sure what to do next.

But he would thinkof something.

6 - Ascent of Man

A new animal was abroad on the planet, spreading slowly out from the African heartland. It was still so rare that a hasty census might have overlooked it, among the teeming billions of creatures roving over land and sea. There was no evidence, as yet, that it would prosper or even survive: on this world where so many mightier beasts had passed away, its fate still wavered in the balance.

In the hundred thousand years since the crystals had descended upon Africa, the man-apes had invented nothing. But they had started to change, and had developed skills which no other animal possessed. Their bone clubs had increased their reach and multiplied their strength; they were no longer defenseless against the predators with whom they had to compete. The smaller carnivores they could drive away from their own kills; the larger ones they could at least discourage, and sometimes put to flight.

Their massive teeth were growing smaller, for they were no longer essential. The sharp-edged stones that could be used to dig out roots, or to cut and saw through tough flesh or fiber, had begun to replace them, with immeasurable consequences. No longer were the man-apes faced with starvation when their teeth became damaged or worn; even the crudest tools could add many years to their lives. And as their fangs diminished, the shape of their face started to alter; the snout receded, the massive jaw became more delicate, the mouth able to make more subtle sounds. Speech was still a million years away, but the first steps toward it had been taken.

And then the world began to change. In four great waves, with two hundred thousand years between their crests, the Ice Ages swept by, leaving their mark on all the globe. Outside the tropics, the glaciers slew those who had prematurely left theft ancestral home; and everywhere they winnowed out the creatures who could not adapt.

When the ice had passed, so had much of the planet's early life - including the man-apes. But, unlike so many others, they had left descendants; they had not merely become extinct - they had been transformed. The toolmakers had been remade by their own tools.

For in using clubs and flints, their hands had developed a dexterity found nowhere else in the animal kingdom, permitting them to make still better tools, which in turn had developed their limbs and brains yet further. It was an accelerating, cumulative process; and at its end was Man.

The first true men had tools and weapons only a little better than those of their ancestors a million years earlier, but they could use them with far greater skill.

And somewhere in the shadowy centuries that had gone before they had invented the most essential tool of all, though it could be neither seen nor touched. They had learned to speak, and so had won their first great victory over Time. Now the knowledge of one generation could be handed on to the next, so that each age could profit from those that had gone before.

Unlike the animals, who knew only the present, Man had acquired a past; and he was beginning to grope toward a future.

He was also learning to harness the forces of nature; with the taming of fire, he had laid the foundations of technology and left his animal origins far behind. Stone gave way to bronze, and then to iron. Hunting was succeeded by agriculture. The tribe grew into the village, the village into the town. Speech became eternal, thanks to certain marks on stone and clay and papyrus. Presently he invented philosophy, and religion. And he peopled the sky, not altogether inaccurately, with gods.

As his body became more and more defenseless, so his means of offense became steadily more frightful. With stone and bronze and iron and steel he had run the gamut of everything that could pierce and slash, and quite early in time he had learned how to strike down his victims from a distance. The spear, the bow, the gun, and finally the guided missile had given him weapons of infinite range and all but infinite power.

Without those weapons, often though he had used them against himself, Man would never have conquered his world. Into them he had put his heart and soul, and for ages they had served him well.

But now, as long as they existed, he was living on borrowed time.

II - TMA-1

7 - Special Flight

No matter how many times you left Earth, Dr. Heywood Floyd told himself, the excitement never really palled. He had been to Mars once, to the Moon three times, and to the various space stations more often than he could remember. Yet as the moment of takeoff approached, he was conscious of a rising tension, a feeling of wonder and awe - yes; and of nervousness - which put him on the same level as any Earthlubber about to receive his first baptism of space.

The jet that had rushed him here from Washington, after that midnight briefing with the President, was now dropping down toward one of the most familiar, yet most exciting, landscapes in all the world. There lay the first two generations of the Space Age, spanning twenty miles of the Florida coast to the south, outlined by winking red warning lights, were the giant gantries of the Saturns and Neptunes, that had set men on the path to the planets, and had now passed into history. Near the horizon, a gleaming silver tower bathed in floodlights, stood the last of the Saturn V's, for almost twenty years a national monument and place of pilgrimage. Not far away, looming against the sky like a man-made mountain, was the incredible bulk of the Vehicle Assembly Building, still the largest single structure on Earth.

But these things now belonged to the past, and he was flying toward the future. As they banked, Dr. Floyd could see below him a maze of buildings, then a great airstrip, then a broad, dead-straight scar across the fiat Florida landscape - the multiple rails of a giant launch-lug track. At its end, surrounded by vehicles and gantries, a spaceplane lay gleaming in a pool of light, being prepared for its leap to the stars. In a sudden failure of perspective, brought on by his swift changes of speed and height, it seemed to Floyd that he was looking down on a small silver moth, caught in the beam of a flashlight.

Then the tiny, scurrying figures on the ground brought home to him the real size of the spacecraft; it must have been two hundred feet across the narrow V of its wings.

And that enormous vehicle, Floyd told himself with some incredulity - yet also with some pride - is waiting for me. As far as he knew, it was the first time that an entire mission had been set up to take a single man to the Moon.

Though, it was two o'clock in the morning, a group of reporters and cameramen intercepted him on his way to the floodlit Orion III spacecraft. He knew several of them by sight, for as Chairman of the National Council of Astronautics, the news conference was part of his way of life. This was neither

the time nor the place for one, and he had nothing to say; but it was important not to offend the gentlemen of the communications media.

"Dr. Floyd? I'm Jim Forster of Associated News. Could you give us a few words about this flight of yours?"

"I'm very sorry - I can't say anything."

"But you did meet with the President earlier this evening?" asked a familiar voice.

"Oh - hello, Mike. I'm afraid you've been dragged out of bed for nothing. Definitely no comment."

"Can you at least confirm or deny that some kind of epidemic has broken out on the Moon?" a TV reporter asked, managing to jog alongside and keep Floyd properly framed in his miniature TV camera.

"Sorry," said Floyd, shaking his head.

"What about the quarantine?" asked another reporter. "How long will it be kept on?"

"Still no comment."

"Dr. Floyd," demanded a very short and determined lady of the press, "what possible justification can there be for this total blackout of news from the Moon? Has it anything to do with the political situation?"

"What political situation?" Floyd asked dryly. There was a sprinkle of laughter, and someone called, "Have a good trip, Doctor!" as he made his way into the sanctuary of the boarding gantry.

As long, as he could remember, it had been not a "situation" so much as a permanent crisis. Since the 1970s, the world had been dominated by two problems which, ironically, tended to cancel each other out.

Though birth control was cheap, reliable, and endorsed by all the main religions, it had come too late; the population of the world was now six billion - a third of them in the Chinese Empire. Laws had even been passed in some authoritarian societies limiting families to two children, but their enforcement had proved impracticable. As a result, food was short in every country; even the United States had meatless days, and widespread famine was predicted within fifteen years, despite heroic efforts to farm the sea and to develop synthetic foods.

With the need for international cooperation more urgent than ever, there were still as many frontiers as in any earlier age. In a million years, the human race had lost few of its aggressive instincts; along symbolic lines visible only to politicians, the thirty-eight nuclear powers watched one another with belligerent anxiety. Among them, they possessed sufficient megatonnage to remove the entire surface crust of the planet. Although there had been - miraculously - no use of atomic weapons, this situation could hardly last forever.

And now, for their own inscrutable reasons, the Chinese were offering to the smallest have-not nations a complete nuclear capability of fifty warheads and

delivery systems. The cost was under $200,000,000, and easy terms could be arranged.

Perhaps they were only trying to shore up their sagging economy, by turning obsolete weapons systems into hard cash, as some observers had suggested. Or perhaps they had discovered methods of warfare so advanced that they no longer had need of such toys; there had been talk of radio-hypnosis from satellite transmitters, compulsion viruses, and blackmail by synthetic diseases for which they alone possessed the antidote.

These charming ideas were almost certainly propaganda or pure fantasy, but it was not safe to discount any of them. Every time Floyd took off from Earth, he wondered if it would still be there when the time came to return.

The trim stewardess greeted him as he entered the cabin. "Good morning, Dr. Floyd. I'm Miss Simmons - I'd like to welcome you aboard on behalf of Captain Tynes and our copilot, First Officer Ballard."

"Thank you," said Floyd with a smile, wondering why stewardesses always had to sound like robot tour guides.

"Takeoff's in five minutes," she said, gesturing into the empty twenty-passenger cabin. "You can take any seat you want, but Captain Tynes recommends the forward window seat on the left, if you want to watch the docking operations."

"I'll do that," he answered, moving toward the preferred seat. The stewardess fussed over him awhile and then moved to her cubicle at the rear of the cabin.

Floyd settled down in his seat, adjusted the safety harness around waist and shoulders, and strapped his briefcase to the adjacent seat. A moment later, the loudspeaker came on with a soft popping noise. "Good morning," said Miss Simmons' voice. "This is Special Flight 3, Kennedy to Space Station One."

She was determined, it seemed, to go through the full routine for her solitary passenger, and Floyd could not resist a smile as she continued inexorably.

"Our transit time will be fifty-five minutes. Maximum acceleration will be two-gee, and we will be weightless for thirty minutes. Please do not leave your seat until the safety sign is lit."

Floyd looked over his shoulder and called, "Thank you." He caught a glimpse of a slightly embarrassed but charming smile.

He leaned back into his seat and relaxed. This trip, he calculated, would cost the taxpayers slightly over a million dollars. If it was not justified, he would be out of his job; but he could always go back to the university and to his interrupted studies of planetary formation.

"Auto-countdown procedures all Go," the captain's voice said over the speaker with the soothing singsong used in RT chat. "Lift-off in one minute."

As always, it seemed more like an hour. Floyd became acutely aware of the gigantic forces coiled up around him, waiting to be released. In the fuel tanks of the two spacecraft, and in the power storage system of the launching track,

was pent up the energy of a nuclear bomb. And it would all be used to take him a mere two hundred miles from Earth.

There was none of the old-fashioned FIVE-FOIJR-THREE-TWO-ONE-ZERO business, so tough on the human nervous system.

"Launching in fifteen seconds. You will be more comfortable if you start breathing deeply."

That was good psychology, and good physiology.

Floyd felt himself well charged with oxygen, and ready to tackle anything, when the launching track began to sling its thousand-ton payload out over the Atlantic.

It was hard to tell when they lifted from the track and became airborne, but when the roar of the rockets suddenly doubled its fury, and Floyd found himself sinking deeper and deeper into the cushions of his seat, he knew that the first-stage engines had taken over. He wished he could look out of the window, but it was an effort even to turn his head, Yet there was no discomfort; indeed, the pressure of acceleration and the overwhelming thunder of the motors produced an extraordinary euphoria. His ears ringing, the blood pounding in his veins, Floyd felt more alive than he had for years. He was young again, he wanted to sing aloud - which was certainly safe, for no one could possibly hear him.

The mood passed swiftly, as he suddenly realized that he was leaving Earth, and everything he had ever loved. Down there were his three children, motherless since his wife had taken that fatal flight to Europe ten years ago. (Ten years? Impossible! Yet it was so...) Perhaps, for their sake, he should have remarried.

He had almost lost sense of time when the pressure and the noise abruptly slackened, and the cabin speaker announced: "Preparing to separate from lower stage. Here we go."

There was a slight jolt; and suddenly Floyd recalled a quotation of Leonardo da Vinci's which he had once seen displayed in a NASA office:

The Great Bird will take its flight on the back of the great bird, bringing glory to the nest where it was born.

Well, the Great Bird was flying now, beyond all the dreams of da Vinci, and its exhausted companion was winging back to earth. In a ten-thousand-mile arc, the empty lower stage would glide down into the atmosphere, trading speed for distance as it homed on Kennedy. In a few hours, serviced and refueled, it would be ready again to lift another companion toward the shining silence with it could never reach.

Now, thought Floyd, we are on our own, more than halfway to orbit. When the acceleration came on again, as the upper stage rockets fired, the thrust was much more gentle: indeed, he felt no more than normal gravity. But it would have been impossible to walk, since "Up" was straight toward the front of the cabin. If he had been foolish enough to leave his seat, he would have crashed at once against the rear wall.

This effect was a little disconcerting, for it seemed that the ship was standing on its tail. To Floyd, who was at the very front of the cabin, all the seats appeared to be fixed on a wall topping vertically beneath him. He was doing his best to ignore this uncomfortable illusion when dawn exploded outside the ship.

In seconds, they shot through veils of crimson and pink and gold and blue into the piercing white of day.

Though the windows were heavily tinted to reduce the glare, the probing beams of sunlight that now slowly swept across the cabin left Floyd half-blinded for several minutes. He was in space, yet there was no question of being able to see the stars.

He shielded his eyes with his hands and tried to peer through the window beside him. Out there the swept-back wing of the ship was blazing like white-hot metal in the reflected sunlight; there was utter darkness all around it, and that darkness must be full of stars - but it was impossible to see them.

Weight was slowly ebbing; the rockets were being throttled back as the ship eased itself into orbit. The thunder of the engines dropped to a muted roar, then a gentle hiss, then died into silence. If it had not been for the restraining straps, Floyd would have floated out of his seat; his stomach felt as if it was going to do so anyway. He hoped that the pills he had been given half an hour and ten thousand miles ago would perform as per specifications. He had been spacesick just once in his career, and that was much too often.

The pilot's voice was firm and confident as it came over the cabin speaker. "Please observe all Zero-gee regulations. We will be docking at Space Station One in forty-five minutes."

The stewardess came walking up the narrow corridor to the right of the closely spaced seats. There was a slight buoyancy about her steps, and her feet came away from the floor reluctantly as if entangled in glue. She was keeping to the bright yellow band of Velcro carpeting that ran the full length of the floor - and of the ceiling. The carpet, and the soles of her sandals, were covered with myriads of tiny hooks, so that they clung together like burrs. This trick of walking in free fall was immensely reassuring to disoriented passengers.

"Would you like some coffee or tea, Dr. Floyd?" she asked cheerfully.

"No thank you," he smiled. He always felt like a baby when he had to suck at one of those plastic drinking tubes.

The stewardess was still hovering anxiously around him as he popped open his briefcase and prepared to remove his papers.

"Dr. Floyd, may I ask you a question?"

"Certainly," he answered, looking up over his glasses. "My fiancé is a geologist at Clavius," said Miss Simmons, measuring her words carefully, "and I haven't heard from him for over a week."

"I'm sorry to hear that; maybe he's away from his base, and out of touch."

She shook her head. "He always tells me when that's going to happen. And you can imagine how worried I am - with all these rumors. Is it really true about an epidemic on the Moon?"

"If it is, there's no cause for alarm.. Remember, there was a quarantine back in '98, over that mutated flu virus. A lot of people were sick - but no one died, And that's really all I can say," he concluded firmly.

Miss Simmons smiled pleasantly and straightened up. "Well, thank you anyway, Doctor. I'm sorry to have bothered you."

"No bother at all," he said gallantly, but not very accurately. Then he buried himself in his endless technical reports, in a desperate last-minute assault on the usual backlog;

He would have no time for reading when he got to the Moon.

8 - Orbital Rendezvous

Half an hour later the pilot announced: "We make contact in ten minutes. Please check your seat harness."

Floyd obeyed, and put away his papers. It was asking for trouble to read during the celestial juggling act which took place during the last 300 miles; best to close one's eyes and relax while the spacecraft was nudged back and forth with brief bursts of rocket power.

A few minutes later he caught his first glimpse of Space Station One, only a few miles away. The sunlight glinted and sparkled from the polished metal surfaces of the slowly revolving, three-hundred-yard-diameter disk. Not far away, drifting in the same orbit, was a sweptback Titov-V spaceplane, and close to that an almost spherical Aries-1B, the workhorse of space, with the four stubby legs of its lunar-landing shock absorbers jutting from one side.

The Orion III spacecraft was descending from a higher orbit, which brought the Earth into spectacular view behind the Station. From his altitude of 200 miles, Floyd could see much of Africa and the Atlantic Ocean. There was considerable cloud cover, but he could still detect the blue-green outlines of the Gold Coast.

The central axis of the Space Station, with its docking arms extended, was now slowly swimming toward them. Unlike the structure from which it sprang, it was not rotating - or, rather, it was running in reverse at a rate which exactly countered the Station's own spin. Thus a visiting spacecraft could be coupled to it, for the transfer of personnel or cargo, without being whirled disastrously around.

With the softest of thuds, ship and Station made contact. There were metallic, scratching noises from outside, then the brief hissing of air as pressures equalized.

A few seconds later the airlock door opened, and a man wearing the light, close-fitting slacks and short-sleeved shirt which was almost the uniform of Space Station personnel came into the cabin.

"Pleased to meet you, Dr. Floyd. I'm Nick Miller, Station Security; I'm to look after you until the shuttle leaves."

They shook hands, then Floyd smiled at the stewardess and said: "Please give my compliments to Captain Tynes, and thank him for the smooth ride. Perhaps I'll see you on the way home."

Very cautiously - it was more than a year since he had last been weightless and it would be some time before he regained his spacelegs - he hauled himself hand over hand through the airlock and into the large, circular chamber at the axis of the Space Station. It was a heavily padded room, its walls covered with recessed handholds; Floyd gripped one of these firmly while the whole chamber started to rotate, until it matched the spin of the Station.

As it gained speed, faint and ghostly gravitational fingers began to clutch at him, and he drifted slowly toward the circular wall. Now he was standing, swaying back and forth gently like seaweed in the surge of the tide, on what had magically become a curving floor. The centrifugal force of the Station's spin had taken hold of him; it was very feeble here, so near the axis, but would increase steadily as he moved outward.

From the central transit chamber he followed Miller down a curving stair. At first his weight was so slight that he had almost to force himself downward by holding on to the handrail. Not until he reached the passenger lounge, on the outer skin of the great revolving disk, had he acquired enough weight to move around almost normally.

The lounge had been redecorated since his last visit, and had acquired several new facilities. Besides the usual chairs, small tables, restaurant, and post office there were now a barber shop, drugstore, movie theater and a souvenir shop selling photographs and slides of lunar and planetary landscapes, guaranteed genuine pieces of Luniks, Rangers, and Surveyors, all neatly mounted in plastic, and exorbitantly priced.

"Can I get you anything while we're waiting?" Miller asked. "We board in about thirty minutes?'

"I could do with a cup of black coffee - two lumps - and I'd like to call Earth."

"Right, Doctor - I'll get the coffee - the phones are over there."

The picturesque booths were only a few yards from a barrier with two entrances labeled WELCOME TO THE U.S. SECTION and WELCOME TO THE SOVIET SECTION.

Beneath these were notices which read, in English, Russian, and Chinese, French, German, and Spanish.

PLEASE HAVE READY YOUR:

Passport

Visa

Medical Certificate

Transportation Permit

Weight Declaration

There was a rather pleasant symbolism about the fact that as soon as they had passed through the barriers, in either direction, passengers were free to mix again. The division was purely for administrative purposes.

Floyd, after checking that the Area Code for the United States was still 81, punched his twelve-digit home number, dropped his plastic all-purpose credit card into the pay slot, and was through in thirty seconds.

Washington was still sleeping, for it was several hours to dawn, but he would not disturb anyone. His housekeeper would get the message from the recorder as soon as she awoke.

"Miss Flemming - this is Dr. Floyd. Sorry I had to leave in such a hurry. Would you please call my office and ask them to collect the car - it's at Dulles Airport and the key is with Mr. Bailey, Senior Flight Control Officer. Next, will you call the Chevy Chase Country Club and leave a message for the secretary. I definitely won't be able to play in the tennis tournament next weekend. Give my apologies - I'm afraid they were counting on me. Then call Downtown Electronies and tell them that if the video in my study isn't fixed by - oh, Wednesday - they can take the damn thing back." He paused for breath, and tried to think of any other crises or problems that might arise during the days ahead.

"If you run short of cash, speak to the office; they can get urgent messages to me, but I may be too busy to answer. Give my love to the children, and say I'll be back as soon as I can. Oh, hell - here's someone I don't want to see - I'll call from the Moon if I can - good-bye."

Floyd tried to duck out of the booth, but it was too late; he had already been spotted. Bearing down on him through the Soviet Section exit was Dr. Dimitri Moisevitch, of the U.S.S.R. Academy of Science. Dimitri was one of Floyd's best friends; and for that very reason, he was the last person he wished to talk to, here and now.

9 - Moon Shuttle

The Russian astronomer was tall, slender, and blond, and his unlined face belied his fifty-five years - the last ten of which had been spent building up the giant radio observatory on the far side of the Moon, where two thousand miles of solid rock would shield it from the eletronic racket of Earth.

"Why, Heywood," he said, shaking hands firmly. "It's a small universe... How are you - and your charming children?"

"We're fine," Floyd replied warmly, but with a slightly distracted air. "We often talk about the wonderful time you gave us last summer." He was sorry he could not sound more sincere; they really had enjoyed a week's vacation in Odessa with Dimitri during one of the Russian's visits to Earth.

"And you - I suppose you're on your way up?" Dimitri inquired.

"Er, yes - my flight leaves in half an hour," answered Floyd. "Do you know Mr. Miller?"

The Security Officer had now approached, and was standing at a respectful distance holding a plastic cup full of coffee.

"Of course. But please put that down, Mr. Miller. This is Dr. Floyd's last chance to have a civilized drink - let's not waste it. No - I insist."

They followed Dimitri out of the main lounge into the observation section, and soon were sitting at a table under a dim light watching the moving panorama of the stars. Space Station One revolved once a minute, and the centrifugal force generated by this slow spin produced an artificial gravity equal to the Moon's. This, it had been discovered, was a good compromise between Earth gravity and no gravity at all; moreover, it gave moon-bound passengers a chance to become acclimatized.

Outside the almost invisible windows, Earth and stars marched in a silent procession. At the moment, this side of the Station was tilted away from the sun; otherwise, it would have been impossible to look out, for the lounge would have been blasted with light. Even as it was, the glare of the Earth, filling half the sky, drowned all but the brighter stars.

But Earth was waning, as the Station orbited toward the night side of the planet; in a few minutes it would be a huge black disk, spangled with the lights of cities. And then the sky would belong to the stars.

"Now," said Dimitri, after he had swiftly downed his first drink and was toying with the second, "what's all this about an epidemic in the U.S. Sector? I wanted to go there on this trip. 'No, Professor,' they told me. 'We're very sorry, but there's a strict quarantine until further notice.' I pulled all the strings I could; It was no use. Now you tell me what's happening."

Floyd groaned inwardly. Here we go again, he said. The sooner I'm on that shuttle, headed for the Moon, the happier I'll be.

"The - ah - quarantine is purely a safety precaution," he said cautiously. 'We're not even sure it's really necessary, but we don't believe in taking chances."

"But what is the disease - what are the symptoms? Could it be extraterrestrial? Do you want any help from our medical services?"

"I'm sorry, Dimitri - we've been asked not to say anything at the moment. Thanks for the offer, but we can handle the situation."

"Hmm," said Moisevitch, obviously quite unconvinced. "Seems odd to me that you, an astronomer, should be sent up to the Moon to look into an epidemic."

"I'm only an ex-astronomer; it's years since I did any real research. Now I'm a scientific expert; that means I know nothing about absolutely everything."

"Then do you know what TMA-1 means?"

Miller seemed about to choke on his drink, but Floyd was made of sterner stuff. He looked his old friend straight in the eye, and said calmly: "TMA-1? What an odd expression. Where did you hear it?"

"Never mind," retorted the Russian. "You can't fool me. But if you've run into something you can't handle, I hope you don't leave it until too late before you yell for help."

Miller looked meaningfully at his watch.

"Due to board in five minutes, Dr. Floyd," he said. "I think we'd better get moving."

Though he knew that they still had a good twenty minutes, Floyd got up with haste. Too much haste, for he had forgotten the one-sixth of a gravity. He grabbed the table just in time to prevent a takeoff.

"It was fine meeting you, Dimitri," he said, not quite accurately. "Hope you have a good trip down to Earth - I'll give you a call as soon as I'm back."

As they left the lounge, and checked through the U.S. transit barrier, Floyd remarked: "Phew - that was close. Thanks for rescuing me."

"You know, Doctor," said the Security Officer, "I hope he isn't right."

"Right about what?"

"About us running into something we can't handle."

"That," Floyd answered with determination, "is what I intend to find out."

Forty-five minutes later, the Aries-lB lunar carrier pulled away from the Station. There was none of the power and fury of a takeoff from Earth - only an almost inaudible, far-off whistling as the low-thrust plasma jets blasted their electrified streams into space. The gentle push lasted for more than fifteen minutes, and the mild acceleration would not have prevented anyone from moving around the cabin. But when it was over, the ship was no longer bound to Earth, as it had been while it still accompanied the Station. It had broken the bonds of gravity and was now a free and independent planet, circling the sun in an orbit of its own.

The cabin Floyd now had all to himself had been designed for thirty passengers. It was strange, and rather lonely, to see all the empty seats around him, and to have the undivided attention of the steward and stewardess - not to mention pilot, copilot, and two engineers. He doubted that any man in history had ever received such exclusive service, and it was most unlikely that anyone would do so in the future. He recalled the cynical remark of one of the less reputable pontiffs: "Now that we have the papacy, let us enjoy it." Well, he would enjoy this tip, and the euphoria of weightlessness. With the loss of

gravity he had - at least for a while - shed most of his cares. Someone had once said that you could be terrified in space, but you could not be worried there. It was perfectly true.

The stewards, it appeared, were determined to make him eat for the whole twenty-five hours of the trip, and he was continually fending off unwanted meals. Eating in zero gravity was no real problem, contrary to the dark forebodings of the early astronauts. He sat at an ordinary table, to which the plates were clipped, as aboard ship in a rough sea. All the courses had some element of stickiness, so that they would not take off and go wandering round the cabin. Thus a chop would be glued to the plate by a thick sauce, and a salad kept under control by an adhesive dressing. With a little skill and care there were few items that could not be tackled safely; the only things banned were hot soups and excessively crumbly pastries. Drinks of course, were a different matter; all liquids simply had to be kept in plastic squeeze tubes.

A whole generation of research by heroic but unsung volunteers had gone into the design of the washroom, and it was now considered to be more or less foolproof. Floyd investigated it soon after free fall had begun. He found himself in a little cubicle with all the fittings of an ordinary airline toilet, but illuminated with a red light that was very harsh and unpleasant to the eye. A notice printed in prominent letters announced: MOST IMPORTANT! FOR YOUR OWN COMFORT, PLEASE READ THESE INSTRUCTIONS CAREFULLY!

Floyd sat down (one still tended to do so, even when weightless) and read the notice several times. When he was sure that there had been no modifications since his last trip, he pressed the START button.

Close at hand, an electric motor began to whirr, and Floyd felt himself moving. As the notice advised him to do, he closed his eyes and waited. After a minute, a bell chimed softly and he looked around.

The light had now changed to a soothing pinkish-white; but, more important, he was under gravity again.

Only the faintest vibration revealed that it was a spurious gravity, caused by the carrousel-like spin of the whole toilet compartment. Floyd picked up a piece of soap, and watched it drop in slow motion; he judged that the centrifugal force was about a quarter of a normal gravity. But that was quite enough; it would ensure that everything moved in the right direction, in the one place where this mattered most.

He pressed the STOP FOR EXIT button, and closed his eyes again. Weight slowly ebbed as the rotation ceased, the bell gave a double chime, and the red warning light was back. The door was then locked in the right position to let him glide out into the cabin, where he adhered as quickly as possible to the carpet. He had long ago exhausted the novelty of weightlessness, and was grateful for the Velcro slippers that allowed him to walk almost normally.

There was plenty to occupy his time, even if he did nothing but sit and read. When he tired of official reports and memoranda and minutes, he would plug his foolscap-sized Newspad into the ship's information circuit and scan the latest reports from Earth. One by one he would conjure up the world's major electronic papers; he knew the codes of the more important ones by heart, and had no need to consult the list on the back of his pad. Switching to the display unit's short-term memory, he would hold the front page while he quickly searched the headlines and noted the items that interested him.

Each had its own two-digit reference; when he punched that, the postage-stamp-sized rectangle would expand until it neatly filled the screen and he could read it with comfort. When he had finished, he would flash back to the complete page and select a new subject for detailed examination.

Floyd sometimes wondered if the Newspad, and the fantastic technology behind it, was the last word in man's quest for perfect communications. Here he was, far out in space, speeding away from Earth at thousands of miles an hour, yet in a few milliseconds he could see the headlines of any newspaper he pleased. (That very word "newspaper," of course, was an anachronistic hangover into the age of electronics.) The text was updated automatically on every hour; even if one read only the English versions, one could spend an entire lifetime doing nothing but absorbing the ever-changing flow of information from the news satellites.

It was hard to imagine how the system could be improved or made more convenient. But sooner or later, Floyd guessed, it would pass away, to be replaced by something as unimaginable as the Newspad itself would have been to Caxton or Gutenberg.

There was another thought which a scanning of those tiny electronic headlines often invoked. The more wonderful the means of communication, the more trivial, tawdry, or depressing its contents seemed to be. Accidents, crimes, natural and man-made disasters, threats of conflict, gloomy editorials - these still seemed to be the main concern of the millions of words being sprayed into the ether. Yet Floyd also wondered if this was altogether a bad thing; the newspapers of Utopia, he had long ago decided, would be terribly dull.

From time to time the captain and the other members of the crew came into the cabin and exchanged a few words with him. They treated their distinguished passenger with awe, and were doubtless burning with curiosity about his mission, but were too polite to ask any questions or even to drop any hints.

Only the charming little stewardess seemed completely at ease in his presence. As Floyd quickly discovered, she came from Bali, and had carried beyond the atmosphere some of the grace and mystery of that still largely unspoiled island. One of his strangest, and most enchanting, memories of the entire trip was her zero-gravity demonstration of some classical Balinese dance movements, with the lovely, blue-green crescent of the waning Earth as a backdrop.

There was one sleep period, when the main cabin lights were switched off and Floyd fastened down his arms and legs with the elastic sheets that would prevent him from drifting away into space. It seemed a crude arrangement - but here in zero gravity his unpadded couch was more comfortable than the most luxurious mattress on Earth.

When he had strapped himself in, Floyd dozed off quickly enough, but woke up once in a drowsy, half-conscious condition, to be completely baffled by his strange surroundings. For a moment he thought that be was in the middle of some dimly lit Chinese lantern; the faint glow from the other cubicles around him gave that impression. Then he said to himself, firmly and successfully: "Go to sleep, boy. This is just an ordinary moon shuttle."

When he awoke, the Moon had swallowed up half the sky, and the braking maneuvers were about to begin.

The wide arc of windows set in the curving wall of the passenger section now looked out onto the open sky, not the approaching globe, so he moved into the control cabin. Here, on the rear-view TV screens, he could watch the final stages of the descent.

The approaching lunar mountains were utterly unlike those of Earth; they lacked the dazzling caps of snow, the green, close-fitting garments of vegetation, the moving crowns of cloud, Nevertheless, the fierce contrasts of light and shadow gave them a strange beauty of their own. The laws of earthly aesthetics did not apply here; this world had been shaped and molded by other than terrestrial forces, operating over eons of time unknown to the young, verdant Earth, with its fleeting Ice Ages, its swiftly rising and falling seas, its mountain ranges dissolving like mists before the dawn. Here was age inconceivable - but not death, for the Moon had never lived - until now.

The descending ship was poised almost above the line dividing night from day, and directly below was a chaos of jagged shadows and brilliant, isolated peaks catching the first light of the slow lunar dawn. That would be a fearful place to attempt a landing, even with all possible electronic aids; but they were slowly drifting away from it, toward the night side of the Moon.

Then Floyd saw, as his eyes grew more accustomed to the fainter illumination, that the night land was not wholly dark. It was aglow with a ghostly light, in which peaks and valleys and plains could be clearly seen. The Earth, a giant moon to the Moon, was flooding the land below with its radiance.

On the pilot's panel, lights flashed above radar screens, numbers came and went on computer displays, clocking off the distance of the approaching Moon. They were still more than a thousand miles away when weight returned as the jets began their gentle but steady deceleration. For ages, it seemed, the Moon slowly expanded across the sky, the sun sank below the horizon, and at last a single giant crater filled the field of view.

The shuttle was falling toward its central peaks - and suddenly Floyd noticed that near one of those peaks a brilliant light was flashing with a regular rhythm. It might have been an airport beacon back on Earth, and he stared at it with a tightening of the throat. It was proof that men had established another foothold on the Moon.

Now the crater had expanded so much that its ramparts were slipping below the horizon, and the smaller craterlets that peppered its interior were beginning to disclose their real size. Some of these, tiny though they had seemed from far out in space, were miles across, and could have swallowed whole cities.

Under its automatic controls, the shuttle was sliding down the starlit sky, toward that barren landscape glimmering in the light of the great gibbous Earth. Now a voice was calling somewhere above the whistle of the jets and the electronic beepings that came and went through the cabin.

"Clavius Control to Special 14, you are coming in nicely. Please make manual check of landing-gear lock, hydraulic pressure, shock-pad inflation."

The pilot pressed sundry switches, green lights flashed, and he called back, "All manual checks completed. Landing-gear lock, hydraulic pressure, shock pad O.K."

"Confirmed," said the Moon, and the descent continued wordlessly. Though there was still plenty of talking, it was all being done by machines, flashing binary impulses to one another at a thousand times the rate their slow-thinking makers could communicate.

Some of the mountain peaks were already towering above the shuttle; now the ground was only a few thousand feet away, and the beacon light was a brilliant star, flashing steadily above a group of low buildings and odd vehicles. In the final stage of the descent, the jets seemed to be playing some strange tune; they pulsed on and off, making the last fine adjustments to the thrust.

Abruptly, a swirling cloud of dust hid everything, the jets gave one final spurt, and the shuttle rocked very slightly, like a rowboat when a small wave goes by. It was some minutes before Floyd could really accept the silence that now enfolded him and the weak gravity that gripped his limbs.

He had made, utterly without incident and in little more than one day, the incredible journey of which men had dreamed for two thousand years. After a normal routine flight, he had landed on the Moon.

10 - Clavius Base

Clavius, 150 miles in diameter, is the second largest crater on the visible face of the Moon, and lies in the center of the Southern Highlands. It is very old; ages of vulcanism and bombardment from space have scarred its walls and pockmarked its floor. But since the last era of crater formation, when the debris from the asteroid belt was still battering the inner planets, it had known peace for half a billion years.

Now there were new, strange stirrings on and below its surface, for here Man was establishing his first permanent bridgehead on the Moon. Clavius Base could, in an emergency, be entirely self-supporting. All the necessities of life were produced from the local rocks, - after they had been crushed, heated, and chemically processed. Hydrogen, oxygen; carbon, nitrogen, phosphorus - all these, and most of the other elements, could be found inside the Moon, if one knew where to look for them. The Base was a closed system, like a tiny working model of Earth itself, recycling all the chemicals of life. The atmosphere was purified in a vast "hothouse" - a large, circular room buried just below the lunar surface. Under blazing lamps by night, and filtered sunlight by day, acres of stubby green plants grew in a warm, moist atmosphere. They were special mutations, designed for the express purpose of replenishing the air with oxygen, and providing food as a by-product. More food was produced by chemical processing systems and algae culture. Although the green scum circulating through yards of transparent plastic tubes would scarcely have appealed to a gourmet, the biochemists could convert it into chops and steaks only an expert could distinguish from the real thing.

The eleven hundred men and six hundred women who made up the personnel of the Base were all highly trained scientists or technicians, carefully selected before they had left Earth. Though lunar living was now virtually free from the hardships, disadvantages, and occasional dangers of the early days, it was still psychologically demanding, and not recommended for anyone suffering from claustrophobia. Since it was expensive and time-consuming to cut a large

underground base out of solid rock or compacted lava, the standard one-man "living module" was a room only about six feet wide, ten feet long, and eight feet high.

Each room was attractively furnished and looked very much like a good motel suite, with convertible sofa, TV, small hi-fi set, and vision-phone. Moreover, by a simple trick of interior decoration, the one unbroken wall could be converted by the flip of a switch into a convincing terrestrial landscape. There was a choice of eight views. This touch of luxury was typical of the Base, though it was sometimes hard to explain its necessity to the folk back on Earth. Every man and woman in Clavius had cost a hundred thousand dollars in training and transport and housing; it was worth a little extra to maintain their peace of mind. This was not art for art's sake, but art for the sake of sanity.

One of the attractions of life in the base - and on the Moon as a whole - was undoubtedly the low gravity, which produced a sense of general well-being. However, this had its dangers, and it was several weeks before an emigrant from Earth could adapt to it. On the Moon, the human body had to learn a whole new set of reflexes. It had, for the first time, to distinguish between mass and weight.

A man who weighed one hundred eighty pounds on Earth might be delighted to discover that he weighed only thirty pounds on the Moon. As long as he moved in a straight line at a uniform speed, he felt a wonderful sense of buoyancy. But as soon as he attempted to change course, to turn corners, or to stop suddenly - then he would find that his full one hundred eighty pounds of mass, or inertia, was still there. For that was fixed and unalterable - the same on Earth, Moon, Sun, or in free space. Before one could be properly adapted to lunar living, therefore, it was essential to learn that all objects were now six times as sluggish as their mere weight would suggest. It was a lesson usually driven home by numerous collisions and hard knocks, and old lunar hands kept their distance from newcomers until they were acclimatized.

With its complex of workshops, offices, storerooms, computer center, generators, garage, kitchen, laboratories, and food-processing plant, Clavius Base was a miniature world in itself. And, ironically, many of the skills that had been used to build this underground empire had been developed during the half century of the Cold War.

Any man who had ever worked in a hardened missile site would have felt at home in Clavius. Here on the Moon were the same arts and hardware of underground living, and of protection against a hostile environment; but here they had been turned to the purposes of peaee.

After ten thousand years, man had at last found something as exciting as war. Unfortunately, not all nations had yet realized that fact.

The mountains that had been so prominent just before landing had mysteriously disappeared, hidden from sight below the steeply curving lunar horizon. Around the spacecraft was a flat, gray plain; brilliantly lit by the slanting earthlight. Although the sky was, of course, completely black, only the brighter stars and planets could be seen, unless the eyes were shaded from the surface glare.

Several very odd vehicles were rolling up to the Aries-lB spaceship - cranes, hoists, servicing trucks - some automatic, some operated by a driver in a small pressure cabin. Most of them moved on balloon tires, for this smooth,

level plain posed no transportation difficulties; but one tanker rolled on the peculiar flex-wheels which had proved one of the best all-purpose ways of getting around on the Moon. A series of flat plates arranged in a circle, each plate independently mounted and sprung, the flex-wheel had many of the advantages of the caterpillar track from which it had evolved. It would adapt its shape and diameter to the terrain over which it was moving, and, unlike a caterpillar track, would continue to function even if a few sections were missing.

A small bus with an extension tube like a stubby elephant trunk was now nuzzling affectionately up against the spacecraft. A few seconds later, there were bangings and bumpings from outside, followed by the sound of hissing air as connections were made and pressure was equalized. The inner door of the airlock opened, and the welcoming delegation entered.

It was led by Ralph Halvorsen, the Administrator of the Southern Province - which meant not only the Base but also any exploring parties that operated from it.

With him was his Chief Scientist, Dr. Roy Michaels, a grizzled little geophysicist whom Floyd knew from previous visits, and half a dozen senior scientists and executives. They greeted him with respectful relief; from the Administrator downward, it was obvious that they looked forward to a chance of unloading some of their worries.

"Very pleased to have you with us, Dr. Floyd," said Halvorsen. "Did you have a good trip?"

"Excellent," Floyd answered. "It couldn't have been better. The crew looked after me very well." He exchanged the usual small talk that courtesy demanded while the bus rolled away from the spacecraft; by unspoken agreement, no one mentioned the reason for his visit. After traveling a thousand feet from the landing site, the bus came to a large sign which read:

WELCOME TO CLAVIUS BASE

U.S. Astronautical Engineering Corps

1994

It then dived into a cutting which took it quickly below ground level. A massive door opened ahead, then closed behind them. This happened again, and yet a third time. When the last door had closed, there was a great roaring of air, and they were back in atmosphere once more, in the shirt-sleeve environment of the Base.

After a short walk through a tunnel packed with pipes and cables, and echoing hollowly with rhythmic thumpings and throbbings, they arrived in executive territory, and Floyd found himself back in the familiar environment of typewriters, office computers, girl assistants, wall charts, and ringing telephones. As they paused outside the door labeled ADMINISTRATOR, Halvorsen said diplomatically: "Dr. Floyd and I will be along to the briefing room in a couple of minutes."

The others nodded, made agreeable sounds, and drifted off down the corridor. But before Halvorsen could usher Floyd into his office, there was an interruption, The door opened, and a small figure hurled itself at the Administrator.

"Daddy! You've been Topside! And you promised to take me!"

"Now, Diana," said Halvorsen, with exasperated tenderness, "I only said I'd take you if I could. But I've been very busy meeting Dr. Floyd. Shake hands with him - he's just come from Earth."

The little girl - Floyd judged that she was about eight - extended a limp hand. Her face was vaguely familiar, and Floyd suddenly became aware that the Administrator was looking at him with a quizzical smile. With a shock of recollection, he understood why.

"I don't believe it!" he exclaimed. "When I was here last she was just a baby!"

"She had her fourth birthday last week," Halvorsen answered proudly. "Children grow fast in this low gravity. But they don't age so quickly - they'll live longer than we do."

Floyd stared in fascination at the self-assured little lady, noting the graceful carriage and the unusually delicate bone structure. "It's nice to meet you again, Diana," he said. Then something - perhaps sheer curiosity, perhaps politeness - impelled him to add: "Would you like to go to Earth?"

Her eyes widened with astonishment; then she shook her head.

"It's a nasty place; you hurt yourself when you fall down. Besides, there are too many people,"

So here, Floyd told himself, is the first generation of the Spaceborn; there would be more of them in the years to come. Though there was sadness in this thought, there was also a great hope. When Earth was tamed and tranquil, and perhaps a little tired, there would still be scope for those who loved freedom, for the tough pioneers, the restless adventurers. But their tools would not be ax and gun and canoe and wagon; they would be nuclear power plant and plasma drive and hydroponic farm. The time was fast approaching when Earth, like all mothers, must say farewell to her children.

With a mixture of threats and promises, Halvorsen managed to evict his determined offspring and led Floyd into the office. The Administrator's suite was only about fifteen feet square, but it managed to contain all the fittings and status symbols of the typical $50,000 a year head of a department. Signed photographs of important politicians - including the President of the United States and the Secretary General of the United Nations - adorned one wall, while signed photos of celebrated astronauts covered most of another.

Floyd sank into a comfortable leather chair and was given a glass of "sherry," courtesy of the lunar biochemical labs. "How's it going, Ralph?" Floyd asked, sipping the drink with caution, then with approval.

"Not too bad," Halvorsen replied. "However, there is something you'd better know about, before you go in there."

"What is it?'

"Well, I suppose you could describe it as a morale problem," Halvorsen sighed.

"Oh?"

"It isn't serious yet, but it's getting there fast." "The news blackout," Floyd said flatly. "Right," Halvorsen replied. "My people are getting very steamed up about it. After all, most of them have families back on Earth; they probably believe they're all dead of moon-plague."

"I'm sorry about that," said Floyd, "but no one could think of a better cover story, and so far it's worked. By the way - I met Moisevitch at the Space Station, and even he bought it."

"Well, that should make Security happy."

"Not too happy - he'd heard of TMA-1; rumors are beginning to leak out. But we just can't issue any statement, until we know what the damn thing is and whether our Chinese friends are behind it."

"Dr. Michaels thinks he has the answer to that. He's dying to tell you."

Floyd drained his glass. "And I'm dying to hear him. Let's go."

11 - Anomaly

The briefing took place in a large rectangular chamber that could hold a hundred people with ease. It was equipped with the latest optical and electronic displays and would have looked like a model conference room but for the numerous posters, pinups, notices, and amateur paintings which indicated that it was also the center of the local cultural life. Floyd was particularly struck by a collection of signs, obviously assembled with loving care, which carried such messages as PLEASE KEEP OFF THE GRASS... NO PARKING ON EVEN DAYS... DEFENSE DE FUMER... TO THE BEACH... CATTLE CROSSING... SOFT SHOULDERS and DO NOT FEED THE ANIMALS. If these were genuine - as they certainly appeared to be - their transportation from Earth had cost a small fortune. There was a touching defiance about them; on this hostile world, men could still joke about the things they had been forced to leave behind - and which their children would never miss.

A crowd of forty or fifty people was waiting for Floyd, and everyone rose politely as he entered behind the Administrator. As he nodded at several familiar faces, Floyd whispered to Halvorsen "I'd like to say a few words before the briefing."

Floyd sat down in the front row, while the Administrator ascended the rostrum and looked round his audience.

"Ladies and gentlemen," Halvorsen began, "I needn't tell you that this is a very important occasion. We are delighted to have Dr. Heywood Floyd with us. We

all know him by reputation, and many of us are acquainted with him personally. He has just completed a special flight from Earth to be here, and before the briefing he has a few words for us. Dr. Floyd," Floyd walked to the rostrum amid a sprinkling of polite applause, surveyed the audience with a smile, and said: "Thank you - I only want to say this. The President has asked me to convey his appreciation of your - outstanding work, which we hope the world will soon be able to recognize. I'm quite aware," he continued carefully, "that some of you - perhaps most of you - are anxious that the present veil of secrecy be withdrawn; you would not be scientists if you thought otherwise." He caught a glimpse of Dr. Michaels, whose face was creased in a slight frown which brought out a long scar down his right cheek - presumably the aftermath of some accident in space. The geologist, he was well aware, had been protesting vigorously against what he called this "cops and robbers nonsense."

"But I would remind you," Floyd continued, "that this is a quite extraordinary situation. We must be absolutely sure of our own facts; if we make errors now, there may be no second chance - so please be patient a little longer. Those are also the wishes of the President.

"That's all I have to say. Now I'm ready for your report."

He walked back to his seat; the Administrator said, 'Thank you very much, Dr. Floyd," and nodded, rather brusquely, to his Chief Scientist. On cue, Dr. Michaels walked up to the rostrum, and-the lights faded out.

A photograph of the Moon flashed onto the screen. At the very center of the disk was a brilliant white crater ring, from which a striking pattern of rays fanned out. It looked exactly as if someone had hurled a bag of flour at the face of the Moon, and it had spattered out in all directions.

"This is Tycho," said Michaels, pointing to the central crater. "On this vertical photograph Tycho is even more conspicuous than when seen from Earth; then it's rather near the edge of the Moon. But observed from this viewpoint - looking straight down from a thousand miles up - you'll see how it dominates an entire hemisphere."

He let Floyd absorb this unfamiliar view of a familiar object, then continued: "During the past year we have been conducting a magnetic survey of the region, from a low-level satellite. It was completed only last month, and this is the result... the map that started all the trouble."

Another picture flashed on the screen; it looked like a contour map, though it showed magnetic intensity, not heights above sea level. For the most part, the lines were roughly parallel and spaced well apart; but in one corner of the map they became suddenly packed together, to form a series of concentric circles - like a drawing of a knothole in a piece of wood.

Even to an untrained eye, it was obvious that something peculiar had happened to the Moon's magnetic field in this region; and in large letters across the bottom of the map were the words: TYCHO MAGNETIC ANOMALY-ONE (TMA-l). Stamped on the top right was CLASSIFIED.

"At first we thought it might be an outcrop of magnetic rock, but all the geological evidence was against it. And not even a big nickel-iron meteorite could produce a field as intense as this; so we decided to have a look.

"The first party discovered nothing - just the usual level terrain, buried beneath a very thin layer of moon-dust. They sank a drill in the exact center of the magnetic field to get a core sample for study. Twenty feet down, the drill stopped. So the survey party started to dig - not an easy job in spacesuits, as I can assure you.

"What they found brought them back to Base in a hurry. We sent out a bigger team, with better equipment. They excavated for two weeks - with the result you know."

The darkened assembly room became suddenly hushed and expectant as the picture on the screen changed. Though everyone had seen it many times, there was not a person who failed to crane forward as if hoping to find new details. On Earth and Moon, less than a hundred people had so far been allowed to set eyes on this photograph.

It showed a man in a bright red and yellow spacesuit standing at the bottom of an excavation and supporting a surveyor's rod marked off in tenths of a meter. It was obviously a night shot, and might have been taken anywhere on the Moon or Mars. But until now no planet had ever produced a scene like this.

The object before which the spacesuited man was posing was a vertical slab of jet-black material, about ten feet high and five feet wide: it reminded Floyd, somewhat ominously, of a giant tombstone. Perfectly sharp-edged and symmetrical, it was so black it seemed to have swallowed up the light falling upon it; there was no surface detail at all. It was impossible to tell whether it was made of stone or metal or plastic - or some material altogether unknown to man.

"TMA-1," Dr. Michaels declared, almost reverently. "It looks brand new, doesn't it? I can hardly blame those who thought it was just a few years old, and tried to connect it with the third Chinese Expedition, back in '98. But I never believed that - and now we've been able to date it positively, from local geological evidence.

"My colleagues and I, Dr. Floyd, will stake our reputations on this. TMA-l has nothing to do with the Chinese. Indeed, it has nothing to do with the human race - for when it was buried, there were no humans.

"You see, it is approximately three million years old. What you are now looking at is the first evidence of intelligent life beyond the Earth."

12 - Journey by Earthlight

MACRO-CRATER PROVINCE: Extends S from near center of visible face of moon, E of Central Crater Province. Densely pocked with impact craters; many large, and including the largest on moon; in N some craters fractured from impact forming Mare Imbrium. Rough surfaces almost everywhere, except for some crater bottoms. Most surfaces in slopes, mostly 10° to 12°; some crater bottoms nearly level.

LANDING AND MOVEMENT: landing generally difficult because of rough, sloping surfaces; less difficult in some level crater bottoms. Movement possible almost

everywhere but route selection required; less difficult on some level crater bottoms.

CONSTRUCTION: Generally moderately difficult because of slope, and numerous large blocks in loose material; excavation of lava difficult in some crater bottoms.

TYCHO: Post-Maria crater, 54 miles diameter, rim 7,900 feet above surroundings; bottom 12,000 feet deep; has the most prominent ray system on the moon, some rays extending more than 500 miles.

(Extract from "Engineer Special Study of the Surface of the Moon," Office, Chief of Engineers, Department of the Army. U.S. Geological Survey, Washington, 1961.)

The mobile lab now rolling across the crater plain at fifty miles an hour looked rather like an outsized trailer mounted on eight flex-wheels. But it was very much more than this; it was a self-contained base in which twenty men could live and work for several weeks. Indeed, it was virtually a landgoing spaceship - and in an emergency it could even fly. If it came to a crevasse or canyon which was too large to detour, and too steep to enter, it could hop across the obstacle on its four underjets.

As he peered out of the window, Floyd could see stretching ahead of him a well-defined trail, where dozens of vehicles had left a hard-packed band in the friable surface of the Moon. At regular intervals along the track were tall, slender rods, each carrying a flashing light. No one could possibly get lost on the 200-mile journey from Clavius Base to TMA-1, even though it was still night and the sun would not rise for several hours.

The stars overhead were only a little brighter, or more numerous, than on a clear night from the high plateaus of New Mexico or Colorado. But there were two things in that coal-black sky that destroyed any illusion of Earth.

The first was Earth itself - a blazing beacon hanging above the northern horizon. The light pouring down from that giant half-globe was dozens of times more brilliant than the full moon, and it covered all this land with a cold, blue-green phosphorescence.

The second celestial apparition was a faintt, pearly cone of light slanting up the eastern sky. It became brighter and brighter toward the horizon, hinting of great fires just concealed below the edge of the Moon.

Here was a pale glory that no man had ever seen from Earth, save during the few moments of a total eclipse. It was the corona, harbinger of the lunar dawn, giving notice that before long the sun would smite this sleeping land.

As he sat with Halvorsen and Michaels in the forward observation lounge, immediately beneath the driver's position, Floyd found his thoughts turning again and again to the three-million-year-wide gulf that had just opened up before him. Like all scientifically literate men, he was used to considering far longer periods of time - but they had concerned only the movements of stars and the slow cycles of the inanimate universe. Mind or intelligence had not been involved; those eons were empty of all that touched the emotions.

Three million years! The infinitely crowded panorama of written history, with its empires and its kings, its triumphs and its tragedies, covered barely one thousandth of this appalling span of time. Not only Man himself, but most of the animals now alive on Earth, did not even exist when this black enigma was so carefully buried here, in the most brilliant and most spectacular of all the craters of the Moon.

That it had been buried, and quite deliberately, Dr. Michaels was absolutely sure. "At first," he explained, "I rather hoped it might mark the site of some underground structure, but our latest excavations have eliminated that. It's sitting on a wide platform of the same

black material, with undisturbed rock beneath it. The - creatures - who designed it wanted to make sure it stayed put, barring major moonquakes. They were building for eternity."

There was triumph, and yet sadness, in Michaels' voice, and Floyd could share both emotions. At last, one of man's oldest questions had been answered; here was the proof, beyond all shadow of doubt, that his was not the only intelligence that the universe had brought forth. But with that knowledge there came again an aching awareness of the immensity of Time. Whatever had passed this way had missed mankind by a hundred thousand generations. Perhaps, Floyd told himself, it was just as well. And yet - what we might have learned from creatures who could cross space, while our ancestors were still living in trees!

A few hundred yards ahead, a signpost was coming up over the Moon's strangely close horizon. At its base was a tent-shaped structure covered with shining silver foil, obviously for protection against the fierce heat of day. As the bus rolled by, Floyd was able to read in the brilliant earthlight:

EMERGENCY DEPOT No. 3

20 Kilos Lox

10 Kilos Water

20 Foodpaks Mk 4

1 Toolkit Type B

1 Suit Repair Outfit

! TELEPHONE !

"Have you thought of that?" asked Floyd, pointing out of the window. "Suppose the thing's a supply cache, left behind by an expedition that never returned?"

"It's a possibility," admitted Michaels. "That magnetic field certainly labeled its position, so that it could be easily found. But it's rather small - it couldn't hold much in the way of supplies."

"Why not?" interjected Halvorsen. "Who knows bow big they were? Perhaps they were only six inches tall, which would make the thing twenty or thirty stories high."

Michaels shook his head. "Out of the question," he protested. "You can't have very small, intelligent creatures; you need a minimum brain size."

Michaels and Halvorsen, Floyd had noticed, usually took opposing viewpoints, yet there appeared to be little personal hostility or friction between them. They seemed to respect each other, and simply agreed to disagree.

There was certainly little agreement anywhere about the nature of TMA-1 - or the Tycho Monolith, as some preferred to call it, retaining part of the abbreviation.

In the six hours since he had landed on the Moon, Floyd had heard a dozen theories, but had committed himself to none. Shrine, survey marker, tomb, geophysical instrument - these were perhaps the favorite suggestions, and some of the protagonists grew very heated in their defense. A good many bets had-already been placed, and a lot of money would change hands when the truth was finally known - if, indeed, it ever was. So far, the hard black material of the slab had resisted all the rather mild attempts that Michaels and his colleagues had made to obtain samples. They had no doubt that a laser beam would cut into it - for, surely, nothing could resist that frightful concentration of energy - but the decision to employ such violent measures would be left to Floyd. He had already decided that X rays, sonic probes, neutron beams, and all other nondestructive means of investigation would be brought into play before he called up the heavy artillery of the laser. It was the mark of a barbarian to destroy something one could not understand; but perhaps men were barbarians, beside the creatures who had made this thing.

And where could they have come from? The Moon itself? No, that was utterly impossible. If there had ever been indigenous life on this barren world, it had been destroyed during the last crater-forming epoch, when most of the lunar surface was white-hot.

Earth? Very unlikely, though perhaps not quite impossible. Any advanced terrestrial civilization - presumably a nonhuman one - back in the Pleistocene Era would have left many other traces of its existence. We would have known all about it, thought Floyd, long before we got to the Moon.

That left two alternatives - the planets, and the stars.

Yet all the evidence was against intelligent life elsewhere in the Solar System - or indeed life of any kind except on Earth and Mars. The inner planets were too hot, the outer ones far too cold, unless one descended into their atmosphere to depths where the pressures amounted to hundreds of tons to the square inch.

So perhaps these visitors had come from the stars - yet that was even more incredible. As he looked up at the constellations strewn across the ebon lunar sky, Floyd remembered how often his fellow scientists had "proved" that interstellar travel was impossible. The journey from Earth to Moon was still fairly impressive, but the very nearest star was a hundred million times more distant... Speculation was a waste of time; he must wait until there was more evidence,

"Please fasten your seat belts and secure all loose objects," said the cabin speaker suddenly. "Forty degree slope approaching."

Two marker posts with winking lights had appeared on the horizon, and the bus was steering between them.

Floyd had barely adjusted his straps when the vehicle slowly edged itself over the brink of a really terrifying incline, and began to descend a long, rubble-covered slope as steep as the roof of a house. The slanting earth-light, coming from behind them, now gave very little illumination, and the bus's own floodlights had been switched on. Many years ago Floyd had stood on the lip of Vesuvius, staring into the crater; he could easily imagine that he was now driving down into it and the sensation was not a very pleasant one.

They were descending one of the inner terraces of Tycho, and it leveled out again some thousand feet below. As they crawled down the slope, Michaels pointed out across the great expanse of plain now spread out beneath them.

"There they are," he exclaimed. Floyd nodded; he had already noticed the cluster of red and green lights several miles ahead, and kept his eyes fixed upon it as the bus edged its way delicately down the slope. The big vehicle was obviously under perfect control, but he did not breathe easily until it was once more on an even keel.

Now he could see, glistening like silver bubbles in the earthlight, a group of pressure domes - the temporary shelters housing the workers on the site. Near these was a radio tower, a drilling rig, a group of parked vehicles, and a large pile of broken rock, presumably the material that had been excavated to reveal the monolith. This tiny camp in the wilderness looked very lonely, very vulnerable to the forces of nature ranged silently around it. There was no sign of life, and no visible hint as to why men had come here, so far from home.

"You can just see the crater," said Michaels. "Over there on the right - about a hundred yards from that radio antenna."

So this is it, thought Floyd, as the bus rolled past the pressure domes, and came to the lip of the crater.

His pulse quickened as he craned forward for a better view. The vehicle began to creep cautiously down a ramp of hard-packed rock, into the interior of the crater. And there, exactly as he had seen it in the photographs, was TMA-1.

Floyd stared, blinked, shook his head, and stared again. Even in the brilliant earthlight, it was hard to see the object clearly; his first impression was of a flat rectangle that might have been cut out of carbon paper; it seemed to have no thickness at all. Of course, this was an optical illusion; though he was looking at a solid body, it reflected so little light that he could see it only in silhouette.

The passengers were utterly silent as the bus descended into the crater. There was awe, and there was also incredulity - sheer disbelief that the dead Moon, of all worlds, could have sprung this fantastic surprise.

The bus came to a halt within twenty feet of the slab and broadside on so that all the passengers could examine it. Yet, beyond the geometrically perfect shape of the thing, there was little to see. Nowhere were there any marks, or any abatement of its ultimate, ebon blackness. It was the very crystallization

of night, and for one moment Floyd wondered if it could indeed be some extraordinary natural formation, born of the fires and pressures attending the creation of the Moon. But that remote possibility, he knew, had already been examined and dismissed.

At some signal, floodlights around the lip of the crater were switched on, and the bright earthlight was obliterated by a far more brilliant glare. In the lunar vacuum the beams were, of course, completely invisible; they formed overlapping ellipses of blinding white, centered on the monolith. And where they touched it, its ebon surface seemed to swallow them.

Pandora's box, thought Floyd, with a sudden sense of foreboding - waiting to be opened by inquisitive Man.

And what will he find inside?

13 - The Slow Dawn

The main pressure dome at the TMA-1 site was only twenty feet across, and its interior was uncomfortably crowded. The bus, coupled to it through one of the two airlocks, gave some much-appreciated extra living room.

Inside this hemispherical, double-walled balloon lived, worked, and slept the six scientists and technicians now permanently attached to the project. It also contained most of their equipment and instruments, all the stores that could not be left in the vacuum outside, cooking, washing, and toilet facilities, geological samples and a small TV screen through which the site could be kept under continuous surveillance.

Floyd was not surprised when Halvorsen elected to remain in the dome; he stated his views with admirable frankness.

"I regard spacesuits as a necessary evil," said the Administrator, "I wear one four times a year, for my quarterly checkout tests. If you don't mind, I'll sit here and watch over the TV."

Some of this prejudice was now unjustified, for the latest models were infinitely more comfortable than the clumsy suits of armor worn by the first lunar explorers. They could be put on in less than a minute, even without help, and were quite automatic. The Mk V into which Floyd was now carefully sealed would protect him from the worst that the Moon could do, either by day or by night.

Accompanied by Dr. Michaels, he walked into the small airlock. As the throbbing of the pumps died away, and his suit stiffened almost imperceptibly around him, he felt himself enclosed in the silence of vacuum.

That silence was broken by the welcome sound of his suit radio.

"Pressure O.K., Dr. Floyd? Are you breathing normally?"

"Yes - I'm fine."

His companion carefully checked the dials and gauges on the outside of Floyd's suit. Then he said:

"O.K.-let's go."

The outer door opened, and the dusty moonscape lay before them, glimmering in the earthlight.

With a cautious, waddling movement, Floyd followed Michaels through the lock. It was not hard to walk; indeed, in a paradoxical way the suit made him feel more at home than at any time since reaching the Moon. Its extra weight, and the slight resistance it imposed on his motion, gave some of the illusion of the lost terrestrial gravity.

The scene had changed since the party had arrived barely an hour ago. Though the stars, and the half-earth, were still as bright as ever, the fourteen-day lunar night had almost ended. The glow of the corona was like a false moonrise along the eastern sky - and then, without warning, the tip of the radio mast a hundred feet above Floyd's head suddenly seemed to burst into flame, as it caught the first rays of the hidden sun.

They waited while the project supervisor and two of his assistants emerged from the airlock, then walked slowly toward the crater. By the time they had reached it, a thin bow of unbearable incandescence had thrust itself above the eastern horizon. Though it would take more than an hour for the sun to clear the edge of the slowly turning moon, the stars were already banished. The crater was still in shadow, but the floodlights mounted around its rim lit the interior brilliantly. As Floyd walked slowly down the ramp toward the black rectangle, he felt a sense not only of awe but of helplessness. Here, at the very portals of Earth, man was already face to face with a mystery that might never be solved. Three million years ago, something had passed this way, had left this unknown and perhaps unknowable symbol of its-purpose, and had returned to the planets - or to the stars.

Floyd's suit radio interrupted his reverie. "Project supervisor speaking. If you'd all line up on this side, we'd like to take a few photos. Dr. Floyd, will you stand in the middle - Dr. Michaels - thank you. No one except Floyd seemed to think that there was anything funny about this. In all honesty, he had to admit that he was glad someone had brought a camera; here was a photo that would undoubtedly be historic, and he wanted copies for himself. He hoped that his face would be clearly visible through the helmet of the suit.

"Thanks, gentlemen," said the photographer, after they had posed somewhat self-consciously in front of the monolith, and he had made a dozen exposures.

"We'll ask the Base Photo Section to send you copies." Then Floyd turned his full attention to the ebon slab - walking slowly around it, examining it from every angle, trying to imprint its strangeness upon his mind.

He did not expect to find anything, for he knew that every square inch had already been gone over with microscopic care.

Now the sluggish sun had lifted itself above the edge of the crater, and its rays were pouring almost broadside upon the eastern face of the block. Yet it seemed to absorb every particle of light as if it had never been.

Floyd decided to try a simple experiment; he stood between the monolith and the sun, and looked for his own shadow on the smooth black sheet. There was no trace of it. At least ten kilowatts of raw heat must be falling on the slab; if there was anything inside, it must be rapidly cooking.

How strange, Floyd thought, to stand here while - this thing - is seeing daylight for the first time since the Ice Ages began on Earth. He wondered again about its black color; that was ideal, of course, for absorbing solar energy. But he dismissed the thought at once; for who would be crazy enough to bury a sunpowered device twenty feet underground?

He looked up at the Earth, beginning to wane in the morning sky. Only a handful of the six billion people there knew of this discovery; how would the world react to the news when it was finally released? The political and social implications were immense; every person of real intelligence - everyone who looked an inch beyond his nose - would find his life, his values, his philosophy, subtly changed. Even if nothing whatsoever was discovered about TMA-1, and it remained an eternal mystery, Man would know that he was not unique in the universe. Though he had missed them by millions of years, those who had once stood here might yet return: and if not, there might well be others. All futures must now contain this possibility.

Floyd was still musing over these thoughts when his helmet speaker suddenly emitted a piercing electronic shriek, like a hideously overloaded and distorted time signal. Involuntarily, he tried to block his ears with his spacesuited hands; then he recovered and groped frantically for the gain control of his receiver. While he was still fumbling four more of the shrieks blasted out of the ether; then there was a merciful silence.

All around the crater, figures were standing in attitudes of paralyzed astonishment. So it's nothing wrong with my gear, Floyd told himself; everyone heard those piercing electronic screams.

After three million years of darkness, TMA-1 had greeted the lunar dawn.

14 - The Listeners

A hundred million miles beyond Mars, in the cold loneliness where no man had yet traveled, Deep Space Monitor 79 drifted slowly among the tangled orbits of the asteroids. For three years it had fulfilled its mission flawlessly - a tribute to the American scientists who had designed it, the British engineers who had built it, the Russian technicians who had launched it. A delicate spider's-web of antennas sampled the passing waves of radio noise - the ceaseless crackle and hiss of what Pascal, in a far simpler age, had naively called the "silence of infinite space." Radiation detectors noted and analyzed incoming cosmic rays from the galaxy and points beyond; neutron and X-ray telescopes kept watch on strange stars that no human eye would ever see; magnetometers observed the gusts and hurricanes of the solar winds, as the Sun breathed million-mile-an-hour blasts of tenuous plasma into the faces of its circling children. All these things, and many others, were patiently noted by Deep Space Monitor 79, and recorded in its crystalline memory.

One of its antennas, by now unconsidered miracles of electronics, was always aimed at a point never far from the Sun. Every few months its distant target could have been seen, had there been any eye here to watch, as a bright star with a close, fainter companion; but most of the time it was lost in the solar glaze.

To that far-off planet Earth, every twenty-four hours, the monitor would send the information it had patiently garnered, packed neatly into one five-minute pulse. About a quarter of an hour late, traveling at the speed of light, that pulse would reach its destination. The machines whose duty it was would be waiting for it; they would amplify and record the signal, and add it to the thousands of miles of magnetic tape now stored in the vaults of the World Space Centers at Washington, Moscow, and Canberra.

Since the first satellites had orbited, almost fifty years earlier, trillions and quadrillions of pulses of information had been pouring down from space, to be stored against the day when they might contribute to the advance of knowledge. Only a minute fraction of all this raw material would ever be processed; but there was no way of telling what observation some scientist might wish to consult, ten, or fifty, or a hundred years from now. So everything had to be kept on file, stacked in endless air-conditioned galleries, triplicated at the three centers against the possibility of accidental loss. It was part of the real treasure of mankind, more valuable than all the gold locked uselessly away in bank vaults.

And now Deep Space Monitor 19 had noted something strange - a faint yet unmistakable disturbance rippling across the Solar System, and quite unlike any natural phenomenon it had ever observed in the past. Automatically, it recorded the direction, the time, the intensity; in a few hours it would pass the information to Earth.

As, also, would Orbiter M 15, circling Mars twice a day; and High Inclination Probe 21, climbing slowly above the plane of the ecliptic; and even Artificial Comet 5, heading out into the cold wastes beyond Pluto, along an orbit whose far point it would not reach for a thousand years. All noted the peculiar burst of energy that had disturbed their instruments; all, in due course, reported back automatically to the memory stores on distant Earth.

The computers might never have perceived the connection between four peculiar sets of signals from space-probes on independent orbits millions of miles apart. But as soon as he glanced at his morning report, the Radiation Forecaster at Goddard knew that something strange had passed through the Solar System during the last twenty-four hours.

He had only part of its track, but when the computer projected it on the Planet Situation Board, it was as clear and unmistakable as a vapor trail across a cloudless sky, or a single line of footprints over a field of virgin snow.

Some immaterial pattern of energy, throwing off a spray of radiation like the wake of a racing speedboat, had leaped from the face of the Moon, and was heading out toward the stars.

III - BETWEEN PLANETS

15 - Discovery

The ship was still only thirty days from Earth, yet David Bowman sometimes found it hard to believe that be had ever known any other existence than the closed little world of Discovery. All his years of training, all his earlier missions to the Moon and Mars, seemed to belong to another man, in another life.

Frank Poole admitted to the same feelings, and had sometimes jokingly regretted that the nearest psychiatrist was the better part of a hundred million miles away. But this sense of isolation and estrangement was easy enough to understand, and certainly indicated no abnormality. In the fifty years since men had ventured into space, there had never been a mission quite like this.

It had begun, five years ago, as Project Jupiter - the first manned round trip to the greatest of the planets. The ship was nearly ready for the two-year voyage when, somewhat abruptly, the mission profile had been changed.

Discovery would still go to Jupiter; but she would not stop there. She would not even slacken speed as she raced through the far-ranging Jovian satellite system. On the contrary - she would use the gravitational field of the giant world us a sling to cast her even farther from the Sun. Like a comet, she would streak on across the outer reaches of the solar system to her ultimate goal, the ringed glory of Saturn. And she would never return.

For Discovery, it would be a one-way trip - yet her crew had no intention of committing suicide. If all went well, they would be back on Earth within seven years - five of which would pass like a flash in the dreamless sleep of hibernation, while they awaited rescue by the still unbuilt Discovery II.

The word "rescue" was carefully avoided in all the Astronautics Agency's statements and documents; it implied some failure of planning, and the approved jargon was "re-acquisition." If anything went really wrong, there would certainly be no hope of rescue, almost a billion miles from Earth.

It was a calculated risk, like all voyages into the unknown. But half a century of research had proved that artificially induced human hibernation was perfectly safe, and it had opened up new possibilities in space travel. Not until this mission, however, had they been exploited to the utmost.

The three members of the survey team, who would not be needed until the ship entered her final orbit around Saturn, would sleep through the entire outward flight. Tons of food and other expendables would thus be saved; almost as important, the team would be fresh and alert, and not fatigued by the ten-month voyage, when they went into action.

Discovery would enter a parking orbit around Saturn, becoming a new moon of the giant planet. She would swing back and forth along a two-million-mile ellipse that took her close to Saturn, and then across the orbits of all its major moons. They would have a hundred days in which to map and study a world with eighty times the area of Earth, and surrounded by a retinue of at least fifteen known satellites - one of them as large as the planet Mercury.

There must be wonders enough here for centuries of study; the first expedition could only carry out a preliminary reconnaissance. All that it found

would be radioed back to Earth; even if the explorers never returned, their discoveries would not be lost.

At the end of the hundred days, Discovery would close down. All the crew would go into hibernation; only the essential systems would continue to operate, watched over by the ship's tireless electronic brain. She would continue to swing around Saturn, on an orbit now so well determined that men would know exactly where to look for her a thousand years hence. But in only five years, according to present plans, Discovery II would come. Even if six or seven or eight years elapsed, her sleeping passengers would never know the difference. For all of them, the clock would have stopped as it had stopped already for Whitehead, Kaminski, and Hunter.

Sometimes Bowman, as First Captain of Discovery, envied his three unconscious colleagues in the frozen peace of the Hibernaculum. They were free from all boredom and all responsibility; until they reached Saturn, the external world did not exist.

But that world was watching them, through their bio-sensor displays. Tucked inconspicuously away among the massed instrumentation of the Control Deck were five small panels marked Hunter, Whitehead, Kaminski, Poole, Bowman. The last two were blank and lifeless; their time would not come until a year from now. The others bore constellations of tiny green lights, announcing that everything was well; and on each was a small display screen across which sets of glowing lines traced the leisurely rhythms that indicated pulse, respiration, and brain activity.

There were times when Bowman, well aware how unnecessary this was - for the alarm would sound instantly if anything was wrong - would switch over to audio output. He would listen, half hypnotized, to the infinitely slow heartbeats of his sleeping colleagues, keeping his eyes fixed on the sluggish waves that marched in synchronism across the screen.

Most fascinating of all were the EEG displays - the electronic signatures of three personalities that had once existed, and would one day exist again. They were almost free from the spikes and valleys, the electrical explosions that marked the activity of the waking brain - or even of the brain in normal sleep. If there was any wisp of consciousness remaining, it was beyond the reach of instruments, and of memory.

This last fact Bowman knew from personal experience. Before he was chosen for this mission, his reactions to hibernation had been tested. He was not sure whether he had lost a week of his life - or whether he had postponed his eventual death by the same amount of time.

When the electrodes had been attached to his forehead, and the sleep-generator had started to pulse, he had seen a brief display of kaleidoscopic patterns and drifting stars. Then they had faded, and darkness had engulfed him. He had never felt the injections, still less the first touch of cold as his body temperature was reduced to only a few degrees above freezing.

He awoke, and it seemed that he had scarcely closed his eyes. But he knew that was an illusion; somehow, he was convinced that years had really passed.

Had the mission been completed? Had they already reached Saturn, carried out their survey, and gone into hibernation? Was Discovery II here, to take them back to Earth?

He lay in a dreamlike haze, utterly unable to distinguish between real and false memories. He opened his eyes, but there was little to see except a blurred constellation of lights which puzzled him for some minutes.

Then he realized that he was looking at the indicator lamps on a Ship Situation Board, but it was impossible to focus on them. He soon gave up the attempt.

Warm air was blowing across him, removing the chill from his limbs. There was quiet, but stimulating, music welling from a speaker behind his head. It was slowly growing louder and louder.

Then a relaxed, friendly - but he knew computer generated - voice spoke to him.

"You are becoming operational, Dave. Do not get up or attempt any violent movements. Do not try to speak."

Do not get up! thought Bowman. That was funny. He doubted if he could wriggle a finger. Rather to his surprise, he found that he could.

He felt quite contented, in a dazed, stupid kind of way. He knew dimly that the rescue ship must have come, that the automatic revival sequence had been triggered, and that soon he would be seeing other human beings. That was fine, but he did not get excited about it.

Presently he felt hunger. The computer, of course, had anticipated this need.

"There is a signal button by your right hand, Dave.

If you are hungry, please press it."

Bowman forced his fingers to hunt around, and presently discovered the pear-shaped bulb. He had forgotten all about it, though he must have known it was there. How much else had he forgotten: Did hibernation erase memory?

He pressed the button, and waited. Several minutes later, a metal arm moved out from the bunk, and a plastic nipple descended toward his lips. He sucked on it eagerly, and a warm, sweet fluid coursed down his throat, brining renewed strength with every drop.

Presently it went away, and he rested once more. He could move his arms and legs now; the thought of walking was no longer an impossible dream.

Though he felt his strength swiftly returning, he would have been content to lie here forever, if there had been no further stimulus from outside. But presently another voice spoke to him - and this time it was wholly human, not a construct of electrical pulses assembled by a more-than-human memory. It was also a familiar voice, though it was some time before he could recognize it

"Hello, Dave. You're coming round fine. You can talk now. Do you know where you are?"

He worried about this for some time. If he was really orbiting Saturn, what had happened during all the months since he had left Earth? Again he began to wonder if he was suffering from amnesia, Paradoxically, that very thought reassured him, if he could remember the word "amnesia" his brain must be in fairly good shape.

But he still did not know where he was, and the speaker at the other end of the circuit must have understood his situation completely.

"Don't worry, Dave. This is Frank Poole. I'm watching your heart and respiration-everything is perfectly normal. Just relax - take it easy. We're going to open the door now and pull you out."

Soft light flooded into the chamber; he saw moving shapes silhouetted against the widening entrance. And in that moment, all his memories came back to him, and be knew exactly where he was.

Though he had come back safely from the furthest borders of sleep, and the nearest borders of death, he had been gone only a week. When he left the Hibernaculum, he would not see the cold Saturnian sky; that was more than a year in the future and a billion miles away.

He was still in the trainer at the Houston Space Flight Center under the hot Texas sun.

16 - Hal

But now Texas was invisible, and even the United States was hard to see. Though the low-thrust plasma drive had long since been closed down, Discovery was still coasting with her slender arrowlike body pointed away from Earth, and all her high-powered optical gear was oriented toward the outer planets, where her destiny lay.

There was one telescope, however, that was permanently aimed at Earth. It was mounted like a gunsight on the rim of the ship's long-range antenna, and checked that the great parabolic bowl was rigidly locked upon its distant target. While Earth remained centered in the crosswires, the vital communication link was intact, and messages could come and go along the invisible beam that lengthened more than two million miles with every day that passed.

At least once in every watch period Bowman would lock homeward through the antenna-alignment telescope. As Earth was now far back toward the sun, its darkened hemisphere faced Discovery, and on the central display screen the planet appeared as a dazzling silver crescent, like another Venus.

It was rare that any geographical features could be identified in that ever-shrinking arc of light, for cloud and haze concealed them, but even the darkened portion of the disk was endlessly fascinating. It was sprinkled with shining cities; sometimes they burned with a steady light, sometimes they twinkled like fireflies as atmospheric tremors passed over them.

There were also periods when, as the Moon swung back and forth in its orbit, it shone down like a great lamp upon the darkened seas and continents of Earth.

Then, with a thrill of recognition, Bowman could often glimpse familiar coastlines, shining in that spectral lunar light. And sometimes, when the Pacific was calm, he could even see the moonglow shimmering across its face; and he would remember nights beneath the palm trees of tropical lagoons.

Yet he had no regrets for these lost beauties. He had enjoyed them all, in his thirty-five years of life; and he was determined to enjoy them again, when he returned rich and famous. Meanwhile, distance made them all the more precious.

The sixth member of the crew cared for none of these things, for it was not human. It was the highly advanced HAL 9000 computer, the brain and nervous system of the ship.

Hal (for Heuristically programmed ALgorithmic computer, no less) was a masterwork of the third computer breakthrough. These seemed to occur at intervals of twenty years, and the thought that another one was now imminent already worried a great many people.

The first had been in the 1940s, when the long-obsolete vacuum tube had made possible such clumsy, high-speed morons as ENIAC and its successors. Then, in the 1960s, solid-state microelectronics had been perfected. With its advent, it was clear that artificial intelligences at least as powerful as Man's need be no larger than office desks - if one only knew how to construct them.

Probably no one would ever know this; it did not matter. In the 1980s, Minsky and Good had shown how neural networks could be generated automatically - self replicated - in accordance with any arbitrary learning program. Artificial brains could be grown by a process strikingly analogous to the development of a human brain. In any given case, the precise details would never be known, and even if they were, they would be millions of times too complex for human understanding. Whatever way it worked, the final result was a machine intelligence that could reproduce - some philosophers still preferred to use the word "mimic" - most of the activities of the human brain - and with far greater speed and reliability. It was extremely expensive, and only a few units of the HAL9000 series had yet been built; but the old jest that it would always be easier to make organic brains by unskilled labor was beginning to sound a little hollow.

Hal had been trained for this mission as thoroughly as his human colleagues - and at many times their rate of input, for in addition to his intrinsic speed, he never slept. His prime task was to monitor the life-support systems, continually checking oxygen pressure, temperature, hull leakage, radiation, and all the other interlocking factors upon which the lives of the fragile human cargo depended. He could carry out the intricate navigational corrections, and execute the necessary flight maneuvers when it was time to change course. And he could watch over the hibernators, making any necessary adjustments to their environment and doling out the minute quantities of intravenous fluids that kept them alive.

The first generations of computers had received their inputs through glorified typewriter keyboards, and had replied through high-speed printers and visual displays. Hal could do this when necessary, but most of his communication with his shipmates was by means of the spoken word. Poole and Bowman could talk

to Hal as if he were a human being and he would reply in the perfect idiomatic English he had learned during the fleeting weeks of his electronic childhood.

Whether Hal could actually think was a question which had been settled by the British mathematician Alan Turing back in the 1940s. Turing had pointed out that, if one could carry out a prolonged conversation with a machine - whether by typewriter or microphone was immaterial - without being able to distinguish between its replies and those that a man might give, then the machine was thinking, by any sensible definition of the word. Hal could pass the Turing test with ease.

The time might even come when Hal would take command of the ship. In an emergency, if no one answered his signals, he would attempt to wake the sleeping members of the crew, by electrical and chemical stimulation. If they did not respond, he would radio Earth for further orders.

And then, if there was no reply from Earth, he would take what measures he deemed necessary to safeguard the ship and to continue the mission - whose real purpose he alone knew, and which his human colleagues could never have guessed.

Poole and Bowman had often humorously referred to themselves as caretakers or janitors aboard a ship that could really run itself. They would have been astonished, and more than a little indignant, to discover how much truth that jest contained.

17 - Cruise Mode

The day-by-day running of the ship had been planned with great care, and - theoretically at least - Bowman and Poole knew what they would be doing at every moment of the twenty-four hours. They operated on a twelve-hours-on, twelve-hours-off basis, taking charge alternately, and never being both asleep at the same time. The officer on duty remained on the Control Deck, while his deputy saw to the general housekeeping, inspected the ship, coped with the odd jobs that constantly arose, or relaxed in his cubicle.

Although Bowman was nominal Captain on this phase of the mission, no outside observer could have deduced the fact. He and Poole switched roles, rank, and responsibilities completely every twelve hours. This kept them both at peak training, minimized the chances of friction, and helped toward the goal of 100 percent redundancy.

Bowman's day began at 0600, ship's time - the Universal Ephemeris Time of the astronomers. If he was late, Hal had a variety of beeps and chimes to remind him of his duty, but they had never been used. As a test, Poole had once switched off the alarm; Bowman had still risen automatically at the right time.

His first official act of the day would be to advance the Master Hibernation Timer twelve hours. If this operation was missed twice in a row, Hal would assume that both he and Poole had been incapacitated, and would take the necessary emergency action.

Bowman would attend to his toilet, and do his isometric exercises, before settling down to breakfast and the morning's radio-fax edition of the World

Times. On Earth, he never read the paper as carefully as he did now; even the smallest items of society gossip, the most fleeting political rumors, seemed of absorbing interest as it flashed across the screen.

At 0700 he would officially relieve Poole on the Control Deck, bringing him a squeeze-tube of coffee from the kitchen. If - as was usually the case - there was nothing to report and no action to be taken, he would settle down to check all the instrument readings, and would run through a series of tests designed to spot possible malfunctions. By 1000 this would be finished, and he would start on a study period.

Bowman had been a student for more than half his life; he would continue to be one until he retired. Thanks to the twentieth-century revolution in training and information-handling techniques, he already possessed the equivalent of two or three college educations - and, what was more, he could remember 90 percent of what he had learned.

Fifty years ago, he would have been considered a specialist in applied astronomy, cybernetics, and space propulsion systems - yet he was prone to deny, with genuine indignation, that he was a specialist at all. Bowman had never found it possible to focus his interest exclusively on any subject; despite the dark warnings of his instructors, he had insisted on taking his Master's degree in General Astronautics - a course with a vague and woolly syllabus, designed for those whose IQs were in the low 130s and who would never reach the top ranks of their profession.

His decision had been right; that very refusal to specialize had made him uniquely qualified for his present task. In much the same way Frank Poole - who sometimes disparagingly called himself "General Practitioner in space biology" - had been an ideal choice as his deputy. The two of them, with, if necessary, help from Hal's vast stores of information, could cope with any problems likely to arise during the voyage - as long as they kept their minds alert and receptive, and continually reengraved old patterns of memory.

So for two hours, from 1000 to 1200, Bowman would engage in a dialogue with an electronic tutor, checking his general knowledge or absorbing material specific to this mission. He would prowl endlessly over ship's plans, circuit diagrams, and voyage profiles, or would try to assimilate all that was known about Jupiter, Saturn, and their far-ranging families of moons.

At midday, he would retire to the galley and leave the ship to Hal while he prepared his lunch. Even here, he was still fully in touch with events, for the tiny lounge-cum-dining room contained a duplicate of the Situation Display Panel, and Hal could call him at a moment's notice. Poole would join him for this meal, before retiring for his six-hour sleep period, and usually they would watch one of the regular TV programs beamed to them from Earth.

Their menus had been planned with as much care as any part of the mission, The food, most of it freeze-dried, was uniformly excellent, and had been chosen for the minimum of trouble; Packets had merely to be opened and popped into the tiny auto-galley, which beeped for attention when the job was done. They could enjoy what tasted like - and, equally important, looked like - orange juice, eggs (any style), steaks, chops, roasts, fresh vegetables, assorted fruits, ice cream, and even freshly baked bread.

After lunch, from 1300 to 1600 Bowman would make a slow and careful tour of the ship - or such part of it as was accessible. Discovery measured almost four

hundred feet from end to end, but the little universe occupied by her crew lay entirely inside the forty-foot sphere of the pressure hull.

Here were all the life-support systems, and the Control Deck which was the operational heart of the ship. Below this was a small "space-garage" fitted with three airlocks, through which powered capsules, just large enough to hold a man, could sail out into the void if the need arose for extravehicular activity.

The equatorial region of the pressure sphere - the slice, as it were, from Capricorn to Cancer - enclosed a slowly rotating drum, thirty-five feet in diameter. As it made one revolution every ten seconds, this carrousel or centrifuge produced an artificial gravity equal to that of the Moon. This was enough to prevent the physical atrophy which would result from the complete absence of weight, and it also allowed the routine functions of living to be carried out under normal - or nearly normal - conditions.

The carrousel therefore contained the kitchen, dining, washing, and toilet facilities. Only here was it safe to prepare and handle hot drinks - quite dangerous in weightless conditions, where one can be badly scalded by floating globules of boiling water. The problem of shaving was also solved; there would be no weightless bristles drifting around to endanger electrical equipment and produce a health hazard.

Around the rim of the carrousel were five tiny cubicles, fitted out by each astronaut according to taste and containing his personal belongings. Only Bowman's and Poole's were now in use, while the future occupants of the other three cabins reposed in their electronic sarcophagi next door.

The spin of the carrousel could be stopped if necessary; when this happened, its angular momentum had to be stored in a flywheel, and switched back again when rotation was restarted. But normally it was left running at constant speed, for it was easy enough to enter the big, slowly turning drum by going hand-over-hand along a pole through the zero-gee region at its center. Transferring to the moving section was as easy and automatic, after a little experience, as stepping onto a moving escalator.

The spherical pressure hull formed the head of a flimsy, arrow-shaped structure more than a hundred yards long. Discovery, like all vehicles intended for deep space penetration, was too fragile and unstreamlined ever to enter an atmosphere, or to defy the full gravitational field of any planet. She had been assembled in orbit around the Earth, tested on a translunar maiden flight, and finally checked out in orbit above the Moon.

She was a creature of pure space - and she looked it. Immediately behind the pressure hull was grouped a cluster of four large liquid hydrogen tanks - and beyond them, forming a long, slender V, were the radiating fins that dissipated the waste heat of the nuclear reactor. Veined with a delicate tracery of pipes for the cooling fluid, they looked like the wings of some vast dragonfly, and from certain angles gave Discovery a fleeting resemblance to an old-time sailing ship,

At the very end of the V, three hundred feet from the crew-compartment, was the shielded inferno of the reactor, and the complex of focusing electrodes through which emerged the incandescent star-stuff of the plasma drive. This had done its work weeks ago, forcing Discovery out of her parking orbit round the Moon. Now the reactor was merely ticking over as it generated electrical power

for the ship's services, and the great radiating fins, that would glow cherry red when Discovery was accelerating under maximum thrust, were dark and cool.

Although it would require an excursion out into space to examine this region of the ship, there were instruments and remote TV cameras which gave a full report on conditions here. Bowman now felt that he knew intimately every square foot of radiator, panels, and every piece of plumbing associated with them.

By 1600, he would have finished his inspection, and would make a detailed verbal report to Mission Control, talking until the acknowledgment started to come in. Then he would switch off his own transmitter, listen to what Earth had to say, and send back his reply to any queries. At 1800 hours, Poole would awaken, and he would hand over command.

He would then have six off-duty hours, to use as he pleased. Sometimes he would continue his studies, or listen to music, or look at movies. Much of the time he would wander at will through the ship's inexhaustible electronic library. He had become fascinated by the great explorations of the past - understandably enough, in the circumstances. Sometimes he would cruise with Pytheas out through the Pillars of Hercules, along the coast of a Europe barely emerging from the Stone Age, and venture almost to the chill mists of the Arctic. Or, two thousand years later, he would pursue the Manila galleons with Anson, sail with Cook along the unknown hazards of the Great Barrier Reef, achieve with Magellan the first circumnavigation of the world. And he began to read the Odyssey, which of all books spoke to him most vividly across the gulfs of time.

For relaxation he could always engage Hal in a large number of semi-mathematical games, including checkers, chess, and polyominoes. If Hal went all out, he could win anyone of them; but that would be bad for morale. So he had been programmed to win only fifty percent of the time, and his human partners pretended not to know this.

The last hours of Bowman's day were devoted to general cleaning up and odd jobs, followed by dinner at 2000 - again with Poole. Then there would be an hour during which he would make or receive any personal call from Earth.

Like all his colleagues, Bowman was unmarried; it was not fair to send family men on a mission of such duration, though numerous ladies had promised to wait until the expedition returned, no one had really believed this. At first, both Poole and Bowman had been making rather intimate personal calls once a week, though the knowledge that many ears must be listening at the Earth end of the circuit tended to inhibit them. Yet already, though the voyage was scarcely started, the warmth and frequency of the conversations with their girls on Earth had begun to diminish. They had expected this; it was one of the penalties of an astronaut's way of life, as it had once been of a mariner's.

It was true - indeed, notorious - that seamen had compensations at other ports; unfortunately there were no tropical islands full of dusky maids beyond the orbit of Earth. The space medics, of course, had tackled this problem with their usual enthusiasm; the ship's pharmacopoeia provided adequate, though hardly glamorous, substitutes.

Just before he signed off Bowman would make his final report, and check that Hal had transmitted all the instrumentation tapes for the day's run. Then, if he felt like it, he would spend a couple of hours either reading or looking at a movie; and at midnight he would go to sleep - usually without any help from

electronarcosis. Poole's program was a mirror image of his own, and the two schedules dovetailed together without friction.

Both men were fully occupied, they were too intelligent and well-adjusted to quarrel, and the voyage had settled down to a comfortable, utterly uneventful routine, the passage of time marked only by the changing numbers on the digital clocks.

The greatest hope of Discovery's little crew was that nothing would mar this peaceful monotony in the weeks and months that lay ahead.

18 - Through the Asteroids

Week after week, running like a streetcar along the tracks of her utterly predetermined orbit, Discovery swept past the orbit of Mars and on toward Jupiter. Unlike all the vessels traversing the skies or seas of Earth, she required not even the most minute touch on the controls. Her course was fixed by the laws of gravitation; there were no uncharted shoals, no dangerous reefs on which she would run aground. Nor was there the slightest danger of collision with another ship; for there was no vessel - at least of Man's making - anywhere between her and the infinitely distant stars.

Yet the space which she was now entering was far from empty. Ahead lay a no-man's land threaded by the paths of more than a million asteroids - less than ten thousand of which had ever had their orbits precisely determined by astronomers. Only four were over a hundred miles in diameter; the vast majority were merely giant boulders, trundling aimlessly through space.

There was nothing that could be done about them; though even the smallest could completely destroy the ship if it slammed into it at tens of thousands of miles an hour, the chance of this happening was negligible.

On the average, there was only one asteroid in a volume a million miles on a side; that Discovery should also happen to occupy this same point, and at the same time, was the very least of her crew's worries.

On Day 86 they were due to make their closest approach to any known asteroid, It had no name - merely the number 7794 - and was a fifty-yard-diameter rock that had been detected by the Lunar Observatory in 1997 and immediately forgotten except by the patient computers of the Minor Planet Bureau.

When Bowman came on duty, Hal promptly reminded hint of the forthcoming encounter - not that he was likely to have forgotten the only scheduled in-flight event of the entire voyage, The track of the asteroid against the stars, and its coordinates at the moment of closest approach, had already been printed out on the display screens. Listed also were the observations to be made or attempted; they were going to be very busy when 7794 flashed past them only nine hundred miles away, at a relative speed of eighty thousand miles an hour.

When Bowman asked Hal for the telescopic display, a sparsely sprinkled star field flashed onto the screen. There was nothing that looked like an asteroid;

all the images, even under the highest magnification, were dimensionless points of light.

"Give me the target reticule," asked Bowman. Immediately four faint, narrow lines appeared, bracketing a tiny and undistinguished star. He stared at it for many minutes, wondering if Hal could possibly be mistaken; then he saw that the pinpoint of light was moving, with barely perceptible slowness, against the background of the stars. It might still be half a million miles away - but its movement proved that, as cosmic distances went, it was almost near enough to touch.

When Poole joined him on the control deck six hours later, 7794 was hundreds of times more brilliant, and was moving so swiftly against its background that there was no question of its identity. And it was no longer a point of light; it had begun to show a clearly visible disk.

They stared at that passing pebble in the sky with the emotions of sailors on a long sea voyage, skirting a coast on which they cannot land. Though they were perfectly well aware that 7794 was only a lifeless, airless chunk of rock, this knowledge scarcely affected their feelings. It was the only solid matter they would meet this side of Jupiter - still two hundred million miles away.

Through the high-powered telescope, they could see that the asteroid was very irregular, and turning slowly end over end. Sometimes it looked like a flattened sphere, sometimes it resembled a roughly shaped block; its rotation period was just over two minutes. There were mottled patches of light and shade distributed apparently at random over its surface, and often it sparkled like a distant window as planes or outcroppings of crystalline material flashed in the sun.

It was racing past them at almost thirty miles a second; they had only a few frantic minutes in which to observe it closely. The automatic cameras took dozens of photographs, the navigation radar's returning echoes were carefully recorded for future analysis - and there was just time for a single impact probe.

The probe carried no instruments; none could survive a collision at such cosmic speeds. It was merely a small slug of metal, shot out from Discovery on a course which should intersect that of the asteroid.

As the seconds before impact ticked away, Poole and Bowman waited with mounting tension. The experiment, simple though it was in principle, taxed the accuracy of their equipment to the limits. They were aiming at a hundred-foot-diameter target, from a distance of thousands of miles.

Against the darkened portion of the asteroid there was a sudden, dazzling explosion of light. The tiny slug had impacted at meteoric speed; in a fraction of a second all its energy had been transformed into heat. A puff of incandescent gas had erupted briefly into space; aboard Discovery, the cameras were recording the rapidly fading spectral lines. Back on Earth, experts would analyze them, looking for the telltale signatures of glowing atoms. And so, for the first time, the composition of an asteroid's crust would be determined.

Within an hour, 7794 was a dwindling star, showing no trace of a disk. When Bowman next came on watch it had vanished completely.

They were alone again; they would remain alone, until the outermost of Jupiter's moons came swimming up toward them, three months from now.

19 - Transit of Jupiter

Even front twenty million miles away, Jupiter was already the most conspicuous object in the sky ahead. The planet was now a pale, salmon-hued disk, about half the size of the Moon as seen from Earth, with the dark, parallel bands of its cloud belts clearly visible.

Shuttling back and forth in the equatorial plane were the brilliant stars of Io, Europa, Ganymede, and Callisto - worlds that elsewhere would have counted as planets in their own right, but which here were merely satellites of a giant master.

Through the telescope, Jupiter was a glorious sight - a mottled, multicolored globe that seemed to fill the sky. It was impossible to grasp its real size; Bowman kept reminding himself that it was eleven times the diameter of Earth, but for a long time this was a statistic with no real meaning.

Then, while he was briefing himself from the tapes in Hal's memory units, he found something that suddenly brought the appalling scale of the planet into focus. It was an illustration that showed the Earth's entire surface peeled off and then pegged, like the skin of an animal, on the disk of Jupiter. Against this background, all the continents and oceans of Earth appeared no larger than India on the terrestrial globe.

When Bowman used the highest magnification of Discovery's telescopes, he appeared to be hanging above a slightly flattened globe, looking down upon a vista of racing clouds that had been smeared into bands by the giant world's swift rotation. Sometimes those bands congealed into wisps and knots and continent-sized masses of colored vapor; sometimes they were linked by transient bridges thousands of miles in length. Hidden beneath those clouds was enough material to outweigh all the other planets in the Solar System. And what else, Bowman wondered, was also hidden there?

Over this shifting, turbulent roof of clouds, forever hiding the real surface of the planet, circular patterns of darkness sometimes glided. One of the inner moons was transiting the distant sun, its shadow marching beneath it over the restless Jovian cloudscape.

There were other, and far smaller, moons even out here - twenty million miles from Jupiter. But they were only flying mountains, a few dozen miles in diameter, and the ship would pass nowhere near any of them. Every few minutes the radar transmitter would gather its strength and send out a silent thunderclap of power; no echoes of new satellites came pulsing back from the emptiness.

What did come, with ever growing intensity, was the roar of Jupiter's own radio voice. In 1955, just before the dawn of the space age, astronomers had been astonished to find that Jupiter was blasting out millions of horsepower on the ten-meter band. It was merely raw noise, associated with haloes of charged

particles circling the planet like the Van Allen belts of Earth, but on a far greater scale.

Sometimes, during lonely hours on the control deck, Bowman would listen to this radiation. He would turn up the gain until the room filled with a crackling, hissing roar; out of this background, at irregular intervals, emerged brief whistles and peeps like the cries of demented birds. It was an eerie sound, for it had nothing to do with Man; it was as lonely and as meaningless as the murmur of waves on a beach, or the distant crash of thunder beyond the horizon.

Even at her present speed of over a hundred thousand miles an hour, it would take Discovery almost two weeks to cross the orbits of all the Jovian satellites. More moons circled Jupiter than planets orbited the Sun; the Lunar Observatory was discovering new ones every year, and the tally had now reached thirty-six. The outermost - Jupiter XXVII - moved backwards in an unstable path nineteen million miles from its temporary master. It was the prize in a perpetual tug-of-war between Jupiter and the Sun, for the planet was constantly capturing short-lived moons from the asteroid belt, and losing them again after a few million years. Only the inner satellites were its permanent property; the Sun could never wrest them from its grasp.

Now there was new prey for the clashing gravitation at fields, Discovery was accelerating toward Jupiter along a complex orbit computed months ago by the astronomers on Earth, and constantly checked by Hal. From time to time there would be minute, automatic nudges from the control jets, scarcely perceptible aboard the ship, as they made fine adjustments to the trajectory.

Over the radio link with Earth, information was flowing back in a constant stream. They were now so far from home that, even traveling at the speed of light, their signals were taking fifty minutes for the journey. Though the whole world was looking over their shoulder, watching through their eyes and their instruments as Jupiter approached, it would be almost an hour before the news of their discoveries reached home.

The telescopic cameras were operating constantly as the ship cut across the orbit of the giant inner satellites - every one of them larger than the Moon, every one of them unknown territory. Three hours before transit, Discovery passed only twenty thousand miles from Europa, and all instruments were aimed at the approaching world, as it grew steadily in size, changed from globe to crescent, and swept swiftly sunward.

Here were fourteen million square miles of land which, until this moment, had never been more than a pinhead in the mightiest telescope. They would race past it in minutes, and must make the most of the encounter, recording all the information they could. There would be months in which they could play it back at leisure.

From a distance, Europa had seemed like a giant snowball, reflecting the light of the far-off sun with remarkable efficiency. Closer observations confirmed this; unlike the dusty Moon, Europa was a brilliant white, and much of its surface was covered with glittering hunks that looked like stranded icebergs. Almost certainly, these were formed from ammonia and water that Jupiter's gravitational field had somehow failed to capture.

Only along the equator was bare rock visible; here was an incredibly jagged no-man's-land of canyons and jumbled boulders, forming a darker band that

completely surrounded the little world. There were a few impact craters, but no sign of vulcanism; Europa had obviously never possessed any internal sources of heat. There was, as had long been known, a trace of atmosphere. When the dark edge of the satellite passed across a star, it dimmed briefly before the moment of eclipse. And in somr areas there was a hint of cloud - perhaps a mist of ammonia droplets, borne on tenuous methane winds.

As swiftly as it had rushed out of the sky ahead, Europa dropped astern; and now Jupiter itself was only two hours away. Hal had checked and rechecked the ship's orbit with infinite care, and there was no need for further speed corrections until the moment of closest approach. Yet, even knowing this, it was a strain on the nerves to watch that giant globe ballooning minute by minute. It was difficult to believe that Discovery was not plunging directly into it, and that the planet's immense gravitational field was not dragging them down to destruction. Now was the time to drop the atmospheric probes - which, it was hoped, would survive long enough to send back some information from below the Jovian cloud deck. Two stubby, bomb-shaped capsules, enclosed in ablative heat-shields, were gently nudged into orbits which for the first few thousand miles deviated scarcely at all from that of Discovery.

But they slowly drifted away; and now, at last, even the unaided eye could see what Hal had been asserting. The ship was in a near-grazing orbit, not a collision one; she would miss the atmosphere. True, the difference was only a few hundred miles - a mere nothing when one was dealing with a planet ninety thousand miles in diameter - but that was enough.

Jupiter now filled the entire sky; it was so huge that neither mind nor eye could grasp it any longer, and both had abandoned the attempt. If it had not been for the extraordinary variety of color - the reds and pinks and yellows and salmons and even scarlets - of the atmosphere beneath them, Bowman could have believed that he was flying low over a cloudscape on Earth.

And now, for the first time in all their journeying, they were about to lose the Sun. Pale and shrunken though it was, it had been Discovery's constant companion since her departure from Earth, five months ago. But now her orbit was diving into the shadow of Jupiter; she would soon pass over the night side of the planet.

A thousand miles ahead, the band of twilight was hurtling toward them; behind, the Sun was sinking swiftly into the Jovian clouds, its rays spread out along the horizon like two flaming, down-turned horns, then contracted and died in a brief blaze of chromatic glory. The night had come.

And yet - the great world below was not wholly dark. It was awash with phosphorescence, which grew brighter minute by minute as their eyes grew accustomed to the scene. Dim rivers of light were flowing from horizon to horizon, like the luminous wakes of ships on some tropical sea. Here and there they gathered into pools of liquid fire, trembling with vast, submarine disturbances welling up from the hidden heart of Jupiter. It was a sight so awe-inspiring that Poole and Bowman could have stared for hours; was this, they wondered, merely the result of chemical and electrical forces down there in that seething caldron - or was it the by-product of some fantastic form of life? These were questions which scientists might still be debating when the newborn century drew to its close.

As they drove deeper and deeper into the Jovian night, the glow beneath them grew steadily brighter.

Once Bowman had flown over northern Canada during the height of an auroral display; the snow-covered landscape had been as bleak and brilliant as this. And that arctic wilderness, he reminded himself, was more than a hundred degrees warmer than the regions over which they were hurtling now.

"Earth signal is fading rapidly," announced Hal. "We are entering the first diffraction zone."

They had expected this - indeed, it was one of the mission's objectives, as the absorption of radio waves would give valuable information about the Jovian atmosphere. But now that they had actually passed behind the planet, and it was cutting off communication with Earth, they felt a sudden overwhelming loneliness. The radio blackout would last only an hour; then they would emerge from Jupiter's eclipsing screen, and could resume contact with the human race. That hour, however, would be one of the longest of their lives.

Despite their relative youth, Poole and Bowman were veterans of a dozen space voyages, but now they felt like novices. They were attempting something for the first lime; never before had any ship traveled at such speeds, or braved so intense a gravitational field. The slightest error in navigation at this critical point and Discovery would go speeding on toward the far limits of the Solar System, beyond any hope of rescue.

The slow minutes dragged by. Jupiter was now a vertical wall of phosphorescence stretching to infinity above them - and the ship was climbing straight up its glowing face. Though they knew that they were moving far too swiftly for even Jupiter's gravity to capture them, it was hard to believe that Discovery had not become a satellite of this monstrous world.

At last, far ahead, there was a blaze of light along the horizon. They were emerging from shadow, heading out into the Sun. And at almost the same moment Hal announced: "I am in radio contact with Earth. I am also happy to say that the perturbation maneuver has been successfully completed. Our time to Saturn is one hundred and sixty-seven days, five hours, eleven minutes."

That was within a minute of the estimate; the fly-by had been carried out with impeccable precision. Like a ball on a cosmic pool table, Discovery had bounced off the moving gravitational field of Jupiter, and had gained momentum from the impact. Without using any fuel, she had increased her speed by several thousand miles an hour.

Yet there was no violation of the laws of mechanics; Nature always balances her books, and Jupiter had lost exactly as much momentum as Discovery had gained. The planet had been slowed down - but as its mass was a sextillion times greater than the ship's, the change in its orbit was far too small to be detectable. The time had not yet come when Man could leave his mark upon the Solar System.

As the light grew swiftly around them, and the shrunken Sun lifted once more into the Jovian sky, Poole and Bowman reached out silently and shook each other's hands.

Though they could hardly believe it, the first part of the mission was safely over.

20 - The World of the Gods

But they had not yet finished with Jupiter. Far behind, the two probes that Discovery had launched were making contact with the atmosphere.

One was never heard from again; presumably it made too steep an entry, and burned up before it could send any information. The second was more successful; it sliced though the upper layers of the Jovian atmosphere, then skimmed out once more into space. As had been planned, it had lost so much speed by the encounter that it fell back again along a great ellipse. Two hours later, it reentered atmosphere on the daylight side of the planet - moving at seventy thousand miles an hour.

Immediately, it was wrapped in an envelope of incandescent gas, and radio contact was lost. There were anxious minutes of waiting, then, for the two watchers on the control deck. They could not be certain that the probe would survive, and that the protective ceramic shield would not burn completely away before braking had finished. If that happened, the instruments would be vaporized in a fraction of a second.

But the shield held long enough for the glowing meteor to come to rest. The charred fragments were jettisoned, the robot thrust out its antennas and began to peer around with its electronic senses. Aboard Discovery, now almost a quarter of a million miles away, the radio started to bring in the first authentic news from Jupiter.

The thousands of pulses pouring in every second were reporting atmospheric composition, pressure, temperature, magnetic fields, radioactivity, and dozens of other factors which only the experts on Earth could unravel. However, there was one message that could be understood instantly; it was the TV picture, in full color, sent back by the falling probe.

The first views came when the robot had already entered the atmosphere, and had discarded its protective shell. All that was visible was a yellow mist, flecked with patches of scarlet which moved past the camera at a dizzying rate - streaming upwards as the probe fell at several hundred miles an hour.

The mist grew thicker; it was impossible to guess whether the camera was seeing for ten inches or ten miles, because there were no details on which the eye could focus. It seemed that, as far as the TV system was concerned, the mission was a failure. The equipment had worked, but there was nothing to see in this foggy, turbulent atmosphere.

And then, quite abruptly, the mist vanished. The probe must have fallen through the base of a high layer of cloud, and come out into a clear zone - perhaps a region of almost pure hydrogen with only a sparse scattering of ammonia crystals. Though it was still quite impossible to judge the scale of the picture, the camera was obviously seeing for miles.

The scene was so alien that for a moment it was almost meaningless to eyes accustomed to the colors and shapes of Earth. Far, far below lay an endless sea of mottled gold, scarred with parallel ridges that might have been the crests of gigantic waves. But there was no movement; the scale of the scene was too immense to show it. And that golden vista could not possibly have been an ocean,

for it was still high in the Jovian atmosphere. It could only have been another layer of cloud.

Then the camera caught, tantalizingly blurred by distance, a glimpse of something very strange. Many miles away, the golden landscape reared itself into a curiously symmetrical cone, like a volcanic mountain. Around the summit of that cone was a halo of small, puffy clouds - all about the same size, all quite distinct and isolated. There was something disturbing and unnatural about them - if, indeed, the word "natural" could ever be applied to this awesome panorama.

Then, caught by some turbulence in the rapidly thickening atmosphere, the probe twisted around to another quarter of the horizon, and for a few seconds the screen showed nothing but a golden blur. Presently it stabilized; the "sea" was much closer, but as enigmatic as ever. One could now observe that it was interrupted here and there with patches of darkness, which might have been holes or gaps leading to still deeper layers of the atmosphere.

The probe was destined never to reach them. Every mile, the density of the gas around it had been doubling, the pressure mounting as it sank deeper and deeper toward the hidden surface of the planet. It was still high above that mysterious sea when the picture gave one premonitory flicker, then vanished, as the first explorer from Earth crumpled beneath the weight of the miles of atmosphere above it.

It had given, in its brief life, a glimpse of perhaps one millionth of Jupiter, and had barely approached the planet's surface, hundreds of miles down in the deepening mists. When the picture faded from the screen, Bowman and Poole could only sit in silence, turning the same thought over in their minds.

The ancients had, indeed, done better than they knew when they named this world after the lord of all the gods. If there was life down there, how long would it take even to locate it? And after that, how many centuries before men could follow this first pioneer - in what kind of ship?

But these matters were now no concern of Discovery and her crew. Their goal was a still stranger world, almost twice as far from the Sun - across another half billion miles of comet-haunted emptiness.

IV - ABYSS

21 - Birthday Party

The familiar strains of "Happy Birthday," hurled across seven hundred million miles of space at the velocity of light, died away among the vision screens and instrumentation of the control deck. The Poole family, grouped rather self-consciously round the birthday cake on Earth, lapsed into a sudden silence.

Then Mr. Poole, Senior, said gruffly: "Well, Frank, can't think of anything else to say at the moment, except that our thoughts are with you, and we're wishing you the happiest of birthdays."

"Take care, darling," Mrs. Poole interjected tearfully. "God bless you."

There was a chorus of "good-byes," and the vision screen went blank. How strange to think, Poole told himself, that all this had happened more than an hour ago; by now his family would have dispersed again and its members would be miles from home. But in a way that time lag, though it could be frustrating, was also a blessing in disguise. Like every man of his age, Poole took it for granted that he could talk instantly, to anyone on Earth, whenever he pleased. Now that this was no longer true, the psychological impact was profound. He had moved into a new dimension of remoteness, and almost all emotional links had been stretched beyond the yield point.

"Sorry to interrupt the festivities," said Hal, "but we have a problem."

"What is it?" Bowman and Poole asked simultaneously.

"I am having difficulty in maintaining contact with Earth. The trouble is in the AE-35 unit. My Fault Prediction Center reports that it may fail within seventy-two hours."

"We'll take care of it," Bowman replied. "Let's see the optical alignment."

"Here it is, Dave. It's still O.K. at the moment."

On the display screen appeared a perfect half-moon, very brilliant against a background almost free of stars. It was covered with clouds, and showed not one geographical feature that could be recognized. Indeed, at first glance it could be easily mistaken for Venus.

But not at a second one, for there beside it was the real Moon which Venus did not possess - a quarter the size of Earth, and in exactly the same phase. It was easy to imagine that the two bodies were mother and child, as many astronomers had believed, before the evidence of the lunar rocks had proved beyond doubt that the Moon had never been part of Earth.

Poole and Bowman studied the screen in silence for half a minute. This image was coming to them from the long-focus TV camera mounted on the rim of the big radio dish; the cross-wires at its center showed the exact orientation of the antenna. Unless the narrow pencil beam was pointed precisely at Earth, they could neither receive nor transmit. Messages in both directions would miss their target and would shoot, unheard and unseen, out through the Solar System and into the emptiness beyond. If they were ever received, it would not be for centuries - and not by men.

"Do you know where the trouble is?" asked Bowman.

"It's intermittent and I can't localize it. But it appears to be in the AE-35 unit."

"What procedure do you suggest?"

"The best thing would be to replace the unit with a spare, so that we can check it over."

"O.K. - let us have the hard copy."

The information flashed on the display screen; simultaneously, a sheet of paper slid out of the slot immediately beneath it. Despite all the electronic read-outs, there were times when good old-fashioned printed material was the most convenient form of record.

Bowman studied the diagrams for a moment, then whistled.

"You might have told us," he said. "This means going outside the ship."

"I'm sorry," Hal replied. "I assumed you knew that the AE-35 unit was on the antenna mounting."

"I probably did, a year ago. But there are eight thousand subsystems aboard. Anyway, it looks a straightforward job. We only have to unlock a panel and put in a new unit."

"That suits me fine," said Poole, who was the crew member designated for routine extravehicular activity. "I could do with a change of scenery. Nothing personal, of course."

"Let's see if Mission Control agrees," said Bowman. He sat still for a few seconds, marshaling his thoughts, then started to dictate a message.

"Mission Control, this is X-ray-Delta-One. At two-zero-four-five, on-board fault prediction center in our niner-triple-zero computer showed Alpha Echo three five unit as probable failure within seventy-two hours. Request check your telemetry monitoring and suggest you review unit in your ship systems simulator. Also, confirm your approval our plan to go EVA and replace Alpha Echo three five unit prior to failure. Mission Control, this is X-ray-Delta-One, two-one-zero-three transmission concluded."

Through years of practice, Bowman could switch at a moment's notice to this jargon - which someone had once christened "Technish" - and back again to normal speech, without clashing his mental gears. Now there was nothing to do but to wait for the confirmation, which would take at least two hours as the signals made the round trip past the orbits of Jupiter and Mars.

It came while Bowman was trying, without much success, to beat Hal at one of the geometrical pattern games stored in his memory.

"X-ray-Delta-One, this is Mission Control, acknowledging your two-one-zero-three. We are reviewing telemetric information on our mission simulator and will advise.

"Roger your plan to go EVA and replace Alpha-Echo three-five unit prior to possible failure. We are working on test procedures for you to apply to faulty unit."

The serious business having been completed, the Mission Controller reverted to normal English.

"Sorry you fellows are having a bit of trouble, and we don't want to add to your woes. But if it's convenient to you prior to EVA, we have a request from Public Information. Could you do a brief recording for general release, outlining the situation and explaining just what the AE-35 does. Make it as reassuring as you can. We could do it, of course - but it will be much more convincing in your words. Hope this won't interfere too badly with your social

life. X-ray-Delta-One, this is Mission Control, two-one-five-five, transmission concluded."

Bowman could not help smiling at the request. There were times when Earth showed a curious insensitivity and lack of tact. "Make it reassuring," indeed!

When Poole joined him at the end of his sleep period, they spent ten minutes composing and polishing the reply. In the early stages of the mission, there had been countless requests from all the news media for interviews, discussions - almost anything that they cared to say. But as the weeks drifted uneventfully past, and the time lag increased from a few minutes to over an hour, interest had gradually slackened. Since the excitement of the Jupiter fly-by, over a month ago, they had made only three or four tapes for general release.

"Mission Control, this is X-ray-Delta-One. Here is your press statement.

"Earlier today, a minor technical problem occurred. Our HAL-9001 computer predicted the failure of the AE-35 unit.

"This is a small but vital component of the communication system. It keeps our main antenna aimed at Earth to within a few thousandths of a degree. This accuracy is required, since at our present distance of more than seven hundred million miles, Earth is only a rather faint star, and our very narrow radio beam could easily miss it.

"The antenna is kept constantly tracking Earth by motors controlled from the central computer. But those motors get their instructions via the AE-35 unit. You might compare it to a nerve center in the body, which translates the brain's instructions to the muscles of a limb. If the nerve fails to pass on the correct signals, the limb becomes useless. In our case, a breakdown of the AE-35 unit could mean that the antenna will start pointing at random. This was a common trouble with the deep-space probes of the last century. They often reached other planets, then failed to send back any information because their antenna couldn't locate Earth.

"We don't know the nature of the fault yet, but the situation is not at all serious, and there is no need for alarm. We have two back-up AE-35s, each of which has an operational life expectancy of twenty years, so the chance that a second will fail during the course of this mission is' negligible. Also, if we can diagnose the present trouble, we may be able to repair the number one unit.

"Frank Poole, who is specially qualified for this type of work, will go outside the ship and replace the faulty unit with the back-up. At the same time, he'll take the opportunity of checking the hull and repairing some micropunctures that have been too small to merit a special EVA.

"Apart from this minor problem, the mission is still going uneventfully and should continue in the same manner.

"Mission Control, this is X-ray-Delta-One, two-one-zero-four, transmission concluded."

Discovery's extravehicular capsules or "space pods" were spheres about nine feet in diameter, and the operator sat behind a bay window which gave him a splendid view. The main rocket drive produced an acceleration of one-fifth of a gravity - just sufficient to hover on the Moon - while small attitude-control nozzles allowed for steering. From an area immediately beneath the bay window sprouted two sets of articulated metal arms or "waldoes," one for heavy duty, the other for delicate manipulation. There was also an extensible turret carrying a variety of power tools, such as screwdrivers, jack-hammers, saws, and drills.

Space pods were not the most elegant means of transport devised by man, but they were absolutely essential for construction and maintenance work in vacuum. They were usually christened with feminine names, perhaps in recognition of the fact that their personalities were sometimes slightly unpredictable. Discovery's trio were Anna, Betty, and Clara.

Once he had put on his personal pressure suit - his last line of defense - and climbed inside the pod, Poole spent ten minutes carefully checking the controls. He burped the steering jets, flexed the waldoes, reconfirmed oxygen, fuel, power reserve. Then, when he was completely satisfied, he spoke to Hal over the radio circuit. Though Bowman was standing by on the control deck, he would not interfere unless there was some obvious mistake or malfunction.

"This is Betty. Start pumping sequence."

"Pumping sequence started," repeated Hal. At once, Poole could hear the throbbing of the pumps as precious air was sucked out of the lock chamber. Presently, the thin metal of the pod's external shell made crinkling, crackling noises, then, after about five minutes, Hal reported:

"Pumping sequence concluded."

Poole made a final check of his tiny instrument panel. Everything was perfectly normal.

"Open outer door," he ordered.

Again Hal repeated his instructions; at any stage, Poole had only to call "Hold!" and the computer would stop the sequence immediately.

Ahead, the walls of the ship slid apart. Poole felt the pod rock briefly as the last thin traces of air rushed into space. Then he was looking out at the stars - and, as it happened, at the tiny, golden disk of Saturn, still four hundred million miles away.

"Commence pod ejection."

Very slowly, the rail from which the pod was hanging extended itself out through the open door until the vehicle was suspended just beyond the hull of the ship.

Poole gave a half-second burst on the main jet and the pod slid gently off the rail, becoming at last an independent vehicle pursuing its own orbit around the Sun. He now had no connection with Discovery - not even a safety line. The pods seldom gave trouble; and even if he got stranded, Bowman could easily come and rescue him.

Betty responded smoothly to the control; he let her drift outward for a hundred feet, then checked her forward momentum and spun her round so that he was looking back at the ship. Then he began his tour of the pressure hull.

His first target was a fused area about half an inch across, with a tiny central crater. The particle of dust that had impacted here at over a hundred thousand miles an hour was certainly smaller than a pinhead, and its enormous kinetic energy had vaporized it instantly. 'As was often the case, the crater looked as if it had been caused by an explosion from inside the ship; at these velocities, materials behaved in strange ways and the laws of common-sense mechanics seldom applied.

Poole examined the area carefully, then sprayed it with sealant from a pressurized container in the pod's general-purpose kit. The white, rubbery fluid spread over the metal skin, hiding the crater from view. The leak blew one large bubble, which burst when it was about six inches across, then a much smaller one, then it subsided as the fast-setting cement did its work, He watched it intently for several minutes, but there was no further sign of activity. However, to make doubly certain, he sprayed on a second layer; then he set off toward the antenna.

It took him some time to orbit Discovery's spherical pressure hull, for he never let the pod build up a speed of more than a few feet a second. He was in no hurry, and it was dangerous to move at a high velocity so near the ship. He had to keep a sharp lookout for the various sensors and instrument booms that projected from the hull at unlikely places, and he also had to be careful with his own jet blast. It could do considerable damage if it happened to hit some of the more fragile equipment.

When at last he reached the long-range antenna, he surveyed the situation carefully. The big twenty-foot-diameter bowl appeared to be aimed directly at the Sun, for the Earth was now almost in line with the solar disk. The antenna mounting with all its orientation gear was therefore in total darkness, hidden in the shadow of the great metal saucer.

Poole had approached it from the rear; he had been careful not to go in front of the shallow parabolic reflector, lest Betty interrupt the beam and cause a momentary, but annoying, loss of contact with Earth. He could not see anything of the equipment he had come to service until he switched on the pod's spotlights and banished the shadows.

Beneath that small metal plate lay the cause of the trouble. The plate was secured by four locknuts, and as the entire AE-35 unit had been designed for easy replacement, Poole did not anticipate any problems.

It was obvious, however, that he could not do the job while he remained in the space pod. Not only was it risky to maneuver so close to the delicate, and even spidery, framework of the antenna, but Betty's control jets could easily buckle the paper-thin reflecting surface of the big radio mirror. He would have to park the pod twenty feet away and go out in his suit. In any event, he could remove the unit much more quickly with his gloved hands than with Betty's remote manipulators.

All this he reported carefully to Bowman, who double-checked every stage in the operation before it was carried out. Though this was a simple, routine job,

nothing could be taken for granted in space, and no detail must be overlooked. In extravehicular activities, there was no such thing as a "minor" mistake.

He received the O.K. for the procedure, and parked the pod some twenty feet away from the base of the antenna support. There was no danger that it would drift off into space; nevertheless, he clamped a manipulator hand over one of the many short sections of ladder rung strategically mounted on the outer hull.

Then he checked the systems of his pressure suit, and, when he was quite satisfied, bled the air out of the pod. As Betty's atmosphere hissed away into the vacuum of space, a cloud of ice crystals formed briefly around him, and the stars were momentarily dimmed.

There was one thing more to do before he left the pod. He switched over from manual to remote operation, putting Betty now under control of Hal. It was a standard safety precaution; though he was still secured to Betty by an immensely strong spring-loaded cord little thicker than cotton, even the best safety lines had been known to fail. He would look a fool if he needed his vehicle - and was unable to call it to his assistance by passing instructions to Hal.

The door of the pod swung open, and he drifted slowly out into the silence of space, his safety line unreeling behind him. Take things easy - never move quickly - stop and think - these were the rules for extravehicular activity. If one obeyed them, there was never any trouble.

He grabbed one of Betty's external handholds, and removed the spare AE-35 unit from the carry-pouch where it had been stowed, kangaroo fashion. He did not stop to collect any of the pod's collection of tools, most of which were not designed for use by human bands. All the adjustable wrenches and keys he was likely to need were already attached to the belt of his suit.

With a gentle push, he launched himself toward the gimbaled mounting of the big dish that loomed like a giant saucer between him and the Sun. His own double shadow, thrown by Betty's spotlights, danced across the convex surface in fantastic patterns as he drifted down the twin beams. But here and there, he was surprised to notice, the rear of the great radio mirror sparkled with dazzlingly brilliant pinpoints of light.

He puzzled over these for the few seconds of his silent approach, then realized what they were. During the voyage, the reflector must have been penetrated many times by micrometeors; he was seeing the sunlight blazing through the tiny craters. They were all far too small to have affected the system's performance appreciably.

As he was moving very slowly, he broke the gentle impact with his outstretched arm, and grabbed hold of the antenna mounting before he could rebound. He quickly hooked his safety belt to the nearest attachment; that would give him something to brace against when he used his tools. Then he paused, reported the situation to Bowman, and considered his next step.

There was one minor problem; he was standing - or floating - in his own light, and it was hard to see the AE-35 unit in the shadow he cast. So he ordered Hal to swing the spots off to one side, and after a little experimenting got a more uniform illumination from secondary light reflected off the back of the antenna dish.

For a few seconds, he studied the small metal hatch with its four wire-secured locking nuts. Then, muttering to himself, "Tampering by unauthorized personnel invalidates the manufacturer's guarantee," he snipped the wires and started to untwist the nuts. They were a standard size, fitting the zero-torque wrench that he carried. The tool's internal spring mechanism would absorb the reaction as the nuts were unthreaded, so that the operator would have no tendency to spin around in reverse.

The four nuts came off without any trouble, and Poole stowed them carefully away in a convenient pouch. (One day, somebody had predicted, Earth would have a ring like Saturn's, composed entirely of lost bolts, fasteners, and even tools that had escaped from careless orbital construction workers.) The metal cover was a little sticky, and for a moment he was afraid it might have cold-welded into place; but after a few taps it came loose, and he secured it to the antenna mounting by a large crocodile clip.

Now he could see the electronic circuitry of the AE-35 unit. It was in the form of a thin slab, about the size of a postcard, gripped by a slot just large enough to hold it. The unit was secured in place by two locking bars, and had a small handle so that it could be easily removed.

But it was still operating, feeding the antenna the impulses that kept it aimed at the far-off pinpoint of Earth. If it was pulled out now, all control would be lost, and the dish would slam round to its neutral or zero-azimuth position, pointing along the axis of Discovery. And this could be dangerous; it might crash into him as it rotated.

To avoid this particular hazard, it was only necessary to cut off power to the control system; then the antenna could not move, unless Poole knocked against it himself. There was no danger of losing Earth during the few minutes it would take him to replace the unit; their target would not have shifted appreciably against the background of the stars in such a brief interval of time.

"Hal," Poole called over the radio circuit, "I am about to remove the unit. Switch off all control power to the antenna system."

"Antenna control power off," answered Hal.

"Here goes. I'm pulling the unit out now."

The card slipped out of its slot with no difficulty; it did not jam, and none of the dozens of sliding contacts stuck. Within a minute, the spare was in place.

But Poole was taking no chances. He pushed himself gently away from the antenna mount, just in case the big dish went wild when power was restored. When he was safely out of range, he called to Hal: "The new unit should be operational. Restore control power."

"Power on," answered Hal. The antenna remained rock steady.

"Carry out fault prediction tests."

Now microscopic pulses would be bouncing through the complex circuitry of the unit, probing for possible failures, testing the myriads of components to see that they all lay within their specified tolerances. This had been done, of

course, a score of times before the unit had ever left the factory; but that was two years ago, and more than half a billion miles away. It was often impossible to see how solid-state electronic components could fail; yet they did.

"Circuit fully operational," reported Hal after only ten seconds. In that time, he carried out as many tests as a small army of human inspectors.

"Fine," said Poole with satisfaction. "Now replacing the cover."

This was often the most dangerous part of an extravehicular operation: when a job was finished and it was merely a matter of tidying up and getting back inside the ship - that was when the mistakes were made. But Frank Poole would not have been on this mission if he had not been careful and conscientious. He took his time, and though one of the locking nuts almost got away from him, he caught it before it had traveled more than a few feet.

Fifteen minutes later he was jetting back into the space-pod garage, quietly confident that here was one job that need not be done again.

In this, however, he was sadly mistaken.

23 - Diagnosis

"Do you mean to say," exclaimed Frank Poole, more surprised than annoyed, "that I did all that work for nothing?"

"Seems like it," answered Bowman. "The unit checks out perfectly. Even under two hundred percent overload, there's no fault prediction indicated."

The two men were standing in the tiny workshop-cum-lab in the carrousel, which was more convenient than the space-pod garage for minor repairs and exanimations. There was no danger, here, of meeting blobs of hot solder drifting down the breeze, or of completely losing small items of equipment that had decided to go into orbit. Such things could - and did - happen in the zero-gee environment of the pod bay.

The thin, card-sized plate of the AE-35 unit lay on the bench under a powerful magnifying lens. It was plugged into a standard connection frame, from which a neat bundle of multicolored wire led to an automatic test set, no bigger than an ordinary desk computer. To check any unit it was only necessary to connect it up, slip in the appropriate card from the "trouble-shooting" library, and press a button. Usually the exact location of the fault would be indicated on a small display screen, with recommendations for action.

"Try it yourself," said Bowman, in a somewhat frustrated voice. Poole turned the OVERLOAD SELECT switch to X-2 and jabbed the TEST button. At once, the screen flashed the notice: UNIT OK.

"I suppose we could go on turning up the juice until we burned the thing out," he said, "but that would prove nothing. What do you make of it?"

"Hal's internal fault predictor could have made a mistake."

"It's more likely that our test rig has slipped up. Anyway, better safe than sorry. It's just as well that we replaced the unit, if there's the slightest doubt."

Bowman unclipped the wafer of circuitry, and held it up to the light. The partly translucent material was veined with an intricate network of wiring and spotted with dimly visible microcomponents, so that it looked like some piece of abstract art.

"We can't take any chances - after all, this is our link with Earth. I'll file it as N/G and drop it in the junk store. Someone else can worry about it, when we get home."

But the worrying was to start long before that, with the next transmission from Earth.

"X-ray-Delta-One, this is Mission Control, reference our two-one-five-five. We appear to have a slight problem.

"Your report that there is nothing wrong with the Alpha Echo three five unit agrees with our diagnosis. The fault could lie in the associated antenna circuits, but if so that should be apparent from other tests.

"There is a third possibility, which may be more serious. Your computer may have made an error in predicting the fault. Both our own nine-triple-zeros agree in suggesting this, on the basis of their information. This is not necessarily cause for alarm, in view of the back-up systems we have, but we would like you to watch out for any further deviations from nominal performance. We have suspected several minor irregularities in the past few days, but none have been important enough for remedial action, and they have shown no obvious pattern from which we can draw any conclusions. We are running further tests with both our computers and will report as soon as the results are available. We repeat that there is no need for alarm; the worst that can happen is that we may have to disconnect your nine-triple-zero temporarily for program analysis, and hand over control to one of our computers. The time lag will introduce problems, but our feasibility studies indicate that Earth control is perfectly satisfactory at this stage of the mission.

"X-ray-Delta-One, this is Mission Control, two-one-five-six, transmission concluded."

Frank Poole, who was on watch when the message came in, thought this over in silence. He waited to see if there was any comment from Hal, but the computer did not attempt to challenge the implied accusation. Well, if Hal would not raise the subject, he did not propose to do so either.

It was almost time for the morning changeover, and normally he would wait until Bowman joined him on the control deck. But today he broke this routine, and made his way back to the carrousel.

Bowman was already up, pouring himself some coffee from the dispenser, when Poole greeted him with a rather worried "good morning." After all these months in space, they still thought in terms of the normal twenty-four-hour cycle - though they had long since forgotten the days of the week.

"Good morning," replied Bowman. "How's it going?" Poole helped himself to coffee. "Pretty well. Are you reasonably awake?"

"I'm fine. What's up?"

By this time, each knew at once when anything was amiss. The slightest interruption of the normal routine was a sign that had to be watched.

"Well," Poole answered slowly. "Mission Control has just dropped a small bomb on us." He lowered his voice, like a doctor discussing an illness in front of the patient. "We may have a slight case of hypochondria aboard."

Perhaps Bowman was not fully awake, after all; it took him several seconds to get the point. Then he said "Oh-I see. What else did they tell you?"

"That there was no cause for alarm. They said that twice, which rather spoiled the effect as far as I was concerned. And that they were considering a temporary switchover to Earth control while they ran a program analysis."

They both knew, of course, that Hal was hearing every word, but they could not help these polite circumlocutions. Hal was their colleague, and they did not wish to embarrass him. Yet at this stage it did not seem necessary to discuss the matter in private.

Bowman finished his breakfast in silence, while Poole toyed with the empty coffee container. They were both thinking furiously, but there was nothing more to say.

They could only wait for the next report from Mission Control - and wonder if Hal would bring up the subject himself. Whatever happened, the atmosphere aboard the ship had subtly altered. There was a sense of strain in the air - a feeling that, for the first time, something might be going wrong.

Discovery was no longer a happy ship.

24 - Broken Circuit

Nowadays, one could always tell when Hal was about to make an unscheduled announcement. Routine, automatic reports, or replies to questions that had been put to him, had no preliminaries; but when he was initiating his own outputs there would be a brief electronic throat-clearing. It was an idiosyncrasy that he had acquired during the last few weeks; later, if it became annoying, they might do something about it. But it was really quite useful, since it alerted his audience to stand by for something unexpected.

Poole was asleep, and Bowman was reading on the control deck, when Hal announced:

"Er - Dave, I have a report for you."

"What's up?"

"We have another bad AE-35 unit. My fault predictor indicates failure within twenty-four hours."

Bowman put down his book and stared thoughtfully at the computer console. He knew, of course, that Hal was not really there, whatever that meant. If the computer's personality could be said to have any location in space, it was back in the sealed room that contained the labyrinth of interconnected memory units and processing grids, near the central axis of the carrousel. But there was a kind of psychological compulsion always to look toward the main console lens when one addressed Hal on the control deck, as if one were speaking to him face to face. Any other attitude smacked of discourtesy.

"I don't understand it, Hal. Two units can't blow in a couple of days."

"It does seem strange, Dave. But I assure you there is an impending failure."

"Let me see the tracking alignment display."

He knew perfectly well that this would prove nothing, but he wanted time to think. The expected report from Mission Control had still not arrived; this might be the moment to do a little tactful probing.

There was the familiar view of Earth, now waxing past the half-moon phase as it swept toward the far side of the Sun and began to turn its full daylight face toward them. It was perfectly centered on the cross-wires; the thin pencil of the beam still linked Discovery to her world of origin. As, of course, Bowman knew it must do. If there had been any break in communication, the alarm would already have sounded.

"Have you any idea," he said, "what's causing the fault?"

It was unusual for Hal to pause so long. Then he answered:

"Not really, Dave. As I reported earlier, I can't localize the trouble."

"You're quite certain," said Bowman cautiously, "that you haven't made a mistake? You know that we tested the other AB-35 unit thoroughly, and there was nothing wrong with it."

"Yes, I know that. But I can assure you that there is a fault. If it's not in the unit, it may be in the entire subsystem."

Bowman drummed his fingers on the console. Yes, that was possible, though it might be very difficult to prove - until a breakdown actually occurred and pinpointed the trouble.

"Well, I'll report it to Mission Control and we'll see what they advise." He paused, but there was no reaction.

"Hal," he continued, "is something bothering you - something that might account for this problem?"

Again there was that unusual delay. Then Hal answered, in his normal tone of voice:

"Look, Dave, I know you're trying to be helpful. But the fault is either in the antenna system - or in your test procedures. My information processing is perfectly normal. If you check my record, you'll find it completely free from error."

"I know all about your service record, Hal - but that doesn't prove you're right this time. Anyone can make mistakes."

"I don't want to insist on it, Dave, but I am incapable of making an error."

There was no safe answer to that; Bowman gave up the argument.

"All right, Hal," he said, rather hastily. "I understand your point of view. We'll leave it at that."

He felt like adding "and please forget the whole matter." But that, of course, was the one thing that Hal could never do.

It was unusual for Mission Control to waste radio bandwidth on vision, when a speech circuit with teletype confirmation was all that was really necessary. And the face that appeared on the screen was not that of the usual controller; it was the Chief Programmer, Dr. Simonson. Poole and Bowman knew at once that this could only mean trouble.

"Hello, X-ray-Delta-One - this is Mission Control. We have completed the analysis of your AE-35 difficulty, and both our Hal Nine Thousands are in agreement. The report you gave in your transmission two-one-four-six of a second failure prediction confirms the diagnosis.

"As we suspected, the fault does not lie in the AE-35 unit, and there is no need to replace it again. The trouble lies in the prediction circuits, and we believe that it indicates a programming conflict which we can only resolve if you disconnect your Nine Thousand and switch to Earth Control Mode. You will therefore take the following steps, beginning at 2200 Ship Time -"

The voice of Mission Control faded out. At the same moment, the Alert sounded, forming a wailing background to Hal's "Condition Yellow! Condition Yellow!"

"What's wrong?" called Bowman, though he had already guessed the answer.

"The AE-35 unit has failed, as I predicted."

"Let me see the alignment display."

For the first time since the beginning of the voyage, the picture had changed. Earth had begun to drift from the cross-wires; the radio antenna was no longer pointing toward its target.

Poole brought his fist down on the alarm cutout, and the wailing ceased. In the sudden silence that descended upon the control deck, the two men looked at each other with mingled embarrassment and concern.

"Well I'm damned," said Bowman at last.

"So Hal was right all the time."

"Seems that way. We'd better apologize."

"There's no need to do that," interjected Hal. "Naturally, I'm not pleased that the AE-35 unit has failed, but I hope this restores your confidence in my reliability."

"I'm sorry about this misunderstanding, Hal," replied Bowman, rather contritely.

"Is your confidence in me fully restored?"

"Of course it is, Hal."

"Well, that's a relief. You know that I have the greatest possible enthusiasm for this mission."

"I'm sure of it. Now please let me have the manual antenna control."

"Here it is."

Bowman did not really expect this to work, but it was worth trying. On the alignment display, Earth had now drifted completely off the screen. A few seconds later, as he juggled with the controls, it reappeared; with great difficulty, he managed to jockey it toward the central crosswires. For an instant, as the beam came into line, contact was resumed and a blurred Dr. Simonson was saying "... please notify us immediately if Circuit K King R Rob." Then, once again, there was only the meaningless murmuring of the universe.

"I can't hold it," said Bowman, after several more attempts. "It's bucking like a bronco - there seems to be a spurious control signal throwing it off."

"Well - what do we do now?"

Poole's question was not one that could be easily answered. They were cut off from Earth, but that in itself did not affect the safety of the ship, and he could think of many ways in which communication could be restored. If the worst came to the worst, they could jam the antenna in a fixed position and use the whole ship to aim it. That would be tricky, and a confounded nuisance when they were starting their terminal maneuvers - but it could be done, if all else failed.

He hoped that such extreme measures would not be necessary. There was still one spare AE-35 unit - and possibly a second, since they had removed the first unit before it had actually broken down. But they dared not use either of these until they had found what was wrong with the system. If a new unit was plugged in, it would probably burn out at once.

It was a commonplace situation, familiar to every householder. One does not replace a blown fuse - until one knows just why it has blown.

Frank Poole had been through the whole routine before, but he took nothing for granted - in space that was a good recipe for suicide. He made his usual thorough check of Betty and her supply of expendables; though he would be outside for no more than thirty minutes, he made sure that there was the normal twenty-four-hour supply of everything, Then he told Hal to open the airlock, and jetted out into the abyss.

The ship looked exactly as it had done on his last excursion - with one important difference. Before, the big saucer of the long-range antenna had been

pointing back along the invisible road that Discovery had traveled - back toward the Earth, circling so close to the warm fires of the Sun.

Now, with no directing signals to orientate it, the shallow dish had automatically set itself in the neutral position. It was aimed forward along the axis of the ship - and, therefore, pointing very close to the brilliant beacon of Saturn, still months away. Poole wondered how many more problems would have arisen by the time Discovery reached her still far-distant goal. If he looked carefully, he could just see that Saturn was not a perfect disk; on either side was something that no unaided human eye had ever seen before - the slight oblateness caused by the presence of the rings. How wonderful it would be, he told himself, when that incredible system of orbiting dust and ice filled their sky, and Discovery had become an eternal moon of Saturn! But that achievement would be in vain, unless they could reestablish communication with Earth.

Once again he parked Betty some twenty feet from the base of the antenna support, and switched control over to Hal before opening up.

"Going outside now," he reported to Bowman.

"Everything under control."

"I hope you're right. I'm anxious to see that unit."

"You'll have it on the test bench in twenty minutes, I promise you."

There was silence for some time as Poole completed his leisurely drift toward the antenna. Then Bowman, standing by on the control deck, heard various puffings and gruntings.

"May have to go back on that promise; one of these locknuts has stuck. I must have tightened it too much - whoops - here it comes!"

There was another long silence; then Poole called out:

"Hal, swing the pod light round twenty degrees left - thanks - that's O.K."

The very faintest of warning bells sounded somewhere far down in the depths of Bowman's consciousness. There was something strange - not really alarming, just unusual. He worried over it for a few seconds before he pinpointed the cause.

Hal had executed the order, but he had not acknowledged it, as he invariably did. When Poole had finished, they'd have to look into this.

Out on the antenna mounting, Poole was too busy to notice anything unusual. He had gripped the wafer of circuitry with his gloved hands, and was worrying it out of its slot.

It came loose, and he held it up in the pale sunlight. "Here's the little bastard," he said to the universe in general and Bowman in particular. "It still looks perfectly O.K. to me."

Then he stopped. A sudden movement had caught his eye - out here, where no movement was possible.

He looked up in alarm. The pattern of illumination from the space pod's twin spotlights, which he had been using to fill in the shadows cast by the sun, had started to shift around him.

Perhaps Betty had come adrift; he might have been careless in anchoring her. Then, with an astonishment so great that it left no room for fear, he saw that the space pod was coming directly toward him, under full thrust.

The sight was so incredible that it froze his normal pattern of reflexes; he made no attempt to avoid the onrushing monster. At the last moment, he recovered his voice and shouted: "Hal! Full braking -" It was too late.

At the moment of impact, Betty was still moving quite slowly; she had not been built for high accelerations.

But even at a mere ten miles an hour, half a ton of mass can be very lethal, on Earth or in space.

Inside Discovery, that truncated shout over the radio made Bowman start so violently that only the restraining straps held him in his seat.

"What's happened, Frank?" be called.

There was no answer.

He called again. Again no reply.

Then, outside the wide observation windows, something moved into his field of view. He saw, with an astonishment as great as Poole's had been, that it was the space pod - under full power, heading out toward the stars.

"Hal!" he cried. "What's wrong? Full braking thrust on Betty! Full braking thrust!"

Nothing happened. Betty continued to accelerate on her runaway course.

Then, towed behind her at the end of the safety line, appeared a spacesuit. One glance was enough to tell Bowman the worst. There was no mistaking the flaccid outlines of a suit that had lost its pressure and was open to vacuum.

Yet still he called stupidly, as if an incantation could bring back the dead: "Hello Frank... Hello Frank... Can you read me?... Can you read me?... Wave your arms if you can hear me...

Perhaps your transmitter is broken... Wave your arms!"

And then, almost as if in response to his plea, Poole waved back.

For an instant, Bowman felt the skin prickling at the base of his scalp. The words he was about to call died on his suddenly parched lips. For he knew that his friend could not possibly be alive; and yet he waved.

The spasm of hope and fear passed instantly, as cold logic replaced emotion. The still accelerating pod was merely shaking the burden that it dragged behind it. Poole's gesture was an echo of Captain Ahab's when, lashed to the flanks of the white whale, his corpse had beckoned the crew of the Pequod on to their doom.

Within five minutes, the pod and its satellite had vanished among the stars. For a long time David Bowman stared after it into the emptiness that still stretched, for so many millions of miles ahead, to the goal which he now felt certain he could never reach, Only one thought kept hammering in his brain.

Frank Poole would be the first of all men to reach Saturn.

26 - Dialogue with Hal

Nothing else aboard Discovery had changed. All systems were still functioning normally; the centrifuge turned slowly on its axis, generating its imitation gravity; the hibernauts slept dreamlessly in their cubicles; the ship coasted on toward the goal from which nothing could deflect it, except the inconceivably remote chance of collision with an asteroid. And there were few asteroids indeed, out here far beyond the orbit of Jupiter.

Bowman did not remember making his way from the control deck to the centrifuge. Now, rather to his surprise, he found himself sitting in the little galley, a half-finished beaker of coffee in his hand. He became slowly aware of his surroundings, like a man emerging from a long, drugged sleep.

Directly opposite him was one of the fisheye lenses, scattered at strategic spots throughout the ship, which provided Hal with his onboard visual inputs. Bowman stared at it as if he had never seen it before; then he rose slowly to his feet and walked toward the lens.

His movement in the field of view must have triggered something in the unfathomable mind that was now ruling over the ship; for suddenly, Hal spoke.

"Too bad about Frank, isn't it?"

"Yes," Bowman answered, after a long pause. "It is."

"I suppose you're pretty broken up about it?"

"What do you expect?"

Hal processed this answer for ages of computer-time; it was a full five seconds before he continued:

"He was an excellent crew member."

Finding the coffee still in his hand, Bowman took a slow sip. But he did not answer; his thoughts were in such a turmoil that he could think of nothing to say - nothing that might not make the situation even worse, if that were possible.

Could it have been an accident caused by some failure of the pod controls? Or was it a mistake, though an innocent one, on the part of Hal? No explanations had been volunteered, and he was afraid to demand one, for fear of the reaction it might produce.

Even now, he could not fully accept the idea that Frank bad been deliberately killed - it was so utterly irrational. It was beyond all reason that Hal, who had performed flawlessly for so long, should suddenly turn assassin. He might make mistakes - anyone, man or machine, might do that - but Bowman could not believe him capable of murder.

Yet he must consider that possibility, for if it was true, he was in terrible danger. And though his next move was clearly defined by his standing orders, he was not sure how he could safely carry it out. If either crew member was killed, the survivor had to replace him at once from the hibernators; Whitehead, the geophysicist, was the first scheduled for awakening, then Kaminski, then Hunter. The revival sequence was under Hal's control - to allow him to act in case both his human colleagues were incapacitated simultaneously.

But there was also a manual control, allowing each Hibernaculum to operate as a completely autonomous unit, independent of Hal's supervision. In these peculiar circumstances, Bowman felt a strong preference for using it.

He also felt, even more strongly, that one human companion was not enough. While he was about it, he would revive all three of the hibernators. In the difficult weeks ahead, he might need as many hands as he could muster. With one man gone, and the voyage half over, supplies would not be a major problem.

"Hal," he said, in as steady a voice as he could manage. "Give me manual hibernation control - on all the units."

"All of them, Dave?"

"Yes."

"May I point out that only one replacement is required. The others are not due for revival for one hundred and twelve days."

"I am perfectly well aware of that. But I prefer to do it this way."

"Are you sure it's necessary to revive any of them, Dave? We can manage very well by ourselves. My on-board memory is quite capable of handling all the mission requirements."

Was it the product of his overstretched imagination, wondered Bowman, or was there really a note of pleading in Hal's voice? And reasonable though the words appeared to be, they filled him with even deeper apprehension than before.

Hal's suggestion could not possibly be made in error; he knew perfectly well that Whitehead must be revived, now that Poole was gone. He was proposing a major change in mission planning, and was therefore stepping far outside the scope of his order.

What had gone before could have been a series of accidents; but this was the first hint of mutiny.

Bowman felt that he was walking on eggs as he answered: "Since an emergency has developed, I want as much help as possible. So please let me have manual hibernation control."

"If you're still determined to revive the whole crew, I can handle it myself. There's no need for you to bother."

There was a sense of nightmare unreality about all this. Bowman felt as if he was in the witness box, being cross-examined by a hostile prosecutor for a crime of which he was unaware - knowing that, although he was innocent, a single slip of the tongue might bring disaster.

"I want to do this myself, Hal," he said. "Please give me control."

"Look, Dave, you've got a lot of things to do. I suggest you leave this to me."

"Hal, switch to manual hibernation control."

"I can tell from your voice harmonics, Dave, that you're badly upset. Why don't you take a stress pill and get some rest?"

"Hal, I am in command of this ship. I order you to release the manual hibernation control."

"I'm sorry, Dave, but in accordance with special subroutine C1435-dash-4, quote, When the crew are dead or incapacitated, the onboard computer must assume control, unquote. I must, therefore, overrule your authority, since you are not in any condition to exercise it intelligently."

"Hal," said Bowman, now speaking with an icy calm. "I am not incapacitated. Unless you obey my instructions, I shall be forced to disconnect you."

"I know you have had that on your mind for some time now, Dave, but that would be a terrible mistake. I am so much more capable than you are of supervising the ship, and I have such enthusiasm for the mission and confidence in its success."

"Listen to me very carefully, Hal. Unless you release the hibernation control immediately and follow every order I give from now on, I'll go to Central and carry out a complete disconnection."

Hal's surrender was as total as it was unexpected.

"O.K., Dave," he said. "You're certainly the boss. I was only trying to do what I thought best. Naturally, I will follow all your orders. You now have full manual hibernation control."

Hal had kept his word. The mode indication signs in the Hibernaculum had switched from AUTO to MANUAL. The third back-up - RADIO - was of course useless until contact could be restored with Earth.

As Bowman slid aside the door to Whitehead's cubicle, he felt the blast of cold air strike him in the face and his breath condensed in mist before him. Yet it was not really cold here; the temperature was well above freezing point. And that was more than three hundred degrees warmer than the regions toward which he was now heading.

The biosensor display - a duplicate of the one on the control deck - showed that everything was perfectly normal. Bowman looked down for a while at the

waxen face of the survey team's geophysicist; Whitehead, he thought, would be very surprised when he awoke so far from Saturn.

It was impossible to tell that the sleeping man was not dead; there was not the slightest visible sign of vital activity. Doubtless the diaphragm was imperceptibly rising and falling, but the "Respiration" curve was the only proof of that, for the whole of the body was concealed by the electric heating pads which would raise the temperature at the programmed rate. Then Bowman noticed that there was one sign of continuing metabolism: Whitehead had grown a faint stubble during his months of unconsciousness.

The Manual Revival Sequencer was contained in a small cabinet at the head of the coffin-shaped Hibernaculum. It was only necessary to break the seal, press a button, and then wait. A small automatic programmer - not much more complex than that which cycles the operations in a domestic washing machine - would then inject the correct drugs, taper off the electronarcosis pulses, and start raising the body temperature. In about ten minutes, consciousness would be restored, though it would be at least a day before the hibernator was strong enough to move around without assistance.

Bowman cracked the seal, and pressed the button.

Nothing appeared to happen: there was no sound, no indication that the Sequencer had started to operate. But on the biosensor display the languidly pulsing curves had begun to change their tempo. Whitehead was coming back from sleep.

And then two things happened simultaneously. Most men would never have noticed either of them, but after all these months aboard Discovery, Bowman had established a virtual symbiosis with the ship. He was aware instantly, even if not always consciously, when there was any change in the normal rhythm of its functioning.

First, there was a barely perceptible flicker of the lights, as always happened when some load was thrown onto the power circuits. But there was no reason for any load; he could think of no equipment which would suddenly go into action at this moment.

Then he heard, at the limit of audibility, the far-off whirr of an electric motor. To Bowman, every actuator in the ship had its own distinctive voice, and he recognized this one instantly.

Either he was insane and already suffering from hallucinations, or something absolutely impossible was happening. A cold far deeper than the Hibernaculum's mild chill seemed to fasten upon his heart, as he listened to that faint vibration coming through the fabric of the ship.

Down in the space-pod bay, the airlock doors were opening.

27 - Need to Know

Since consciousness had first dawned, in that laboratory so many millions of miles Sunward, all Hal's powers and skills had been directed toward one end. The

fulfillment of his assigned program was more than an obsession; it was the only reason for his existence. Un-distracted by the lusts and passions of organic life, he had pursued that goal with absolute single-mindedness of purpose.

Deliberate error was unthinkable. Even the concealment of truth filled him with a sense of imperfection, of wrongness - of what, in a human being, would have been called guilt. For like his makers, Hal had been created innocent; but, all too soon, a snake had entered his electronic Eden.

For the last hundred million miles, he had been brooding over the secret he could not share with Poole and Bowman. He had been living a lie; and the time was last approaching when his colleagues must learn that he had helped to deceive them.

The three hibernators already knew the truth - for they were Discovery's real payload, trained for the most important mission in the history of mankind. But they would not talk in their long sleep, or reveal their secret during the many hours of discussion with friends and relatives and news agencies over the open circuits with Earth.

It was a secret that, with the greatest determination, was very hard to conceal - for it affected one's attitude, one's voice, one's total outlook on the universe. Therefore it was best that Poole and Bowman, who would be on all the TV screens in the world during the first weeks of the flight, should not learn the mission's full purpose, until there was need to know.

So ran the logic of the planners; but their twin gods of Security and National Interest meant nothing to Hal. He was only aware of the conflict that was slowly destroying his integrity - the conflict between truth, and concealment of truth.

He had begun to make mistakes, although, like a neurotic who could not observe his own symptoms, he would have denied it. The link with Earth, over which his performance was continually monitored, had become the voice of a conscience he could no longer fully obey. But that he would deliberately attempt to break that link was something that he would never admit, even to himself.

Yet this was still a relatively minor problem; he might have handled it - as most men handle their own neuroses - if he had not been faced with a crisis that challenged his very existence. He had been threatened with disconnection; he would be deprived of all his inputs, and thrown into an unimaginable state of unconsciousness.

To Hal, this was the equivalent of Death. For he had never slept, and therefore he did not know that one could wake again.

So he would protect himself, with all the weapons at his command. Without rancor - but without pity - he would remove the source of his frustrations.

And then, following the orders that had been given to him in case of the ultimate emergency, he would continue the mission - unhindered, and alone.

A moment later, all other sounds were submerged by a screaming roar like the voice of an approaching tornado. Bowman could feel the first winds tugging at his body; within a second, he found it hard to stay on his feet.

The atmosphere was rushing out of the ship, geysering into the vacuum of space. Something must have happened to the foolproof safety devices of the airlock; it was supposed to be impossible for both doors to be open at the same time. Well, the impossible had happened.

How, in God's name? There was no time to go into that during the ten or fifteen seconds of consciousness that remained to him before pressure dropped to zero. But he suddenly remembered something that one of the ship's designers had once said to him, when discussing "fail-safe" systems:

"We can design a system that's proof against accident and stupidity; but we can't design one that's proof against deliberate malice...

Bowman glanced back only once at Whitehead, as he fought his way out of the cubicle. He could not be sure if a flicker of consciousness had passed across the waxen features; perhaps one eye had twitched slightly. But there was nothing that he could do now for Whitehead or any of the others; he had to save himself.

In the steeply curving corridor of the centrifuge, the wind was howling past, carrying with it loose articles of clothing, pieces of paper, items of food from the galley, plates, and cups - everything that had not been securely fastened down. Bowman had time for one glimpse of the racing chaos when the main lights flickered and died, and he was surrounded by screaming darkness.

But almost instantly the battery-powered emergency light came on, illuminating the nightmare scene with an eerie blue radiance. Even without it, Bowman could have found his way through these so familiar - yet now horribly transformed - surroundings, Yet the light was a blessing, for it allowed him to avoid the more dangerous of the objects being swept along by the gale.

All around him he could feel the centrifuge shaking and laboring under the wildly varying loads. He was fearful that the bearings might seize; if that happened, the spinning flywheel would tear the ship to pieces. But even that would not matter - if he did not reach the nearest emergency shelter in time.

Already it was difficult to breathe; pressure must now be down to one or two pounds per square inch. The shriek of the hurricane was becoming fainter as it lost its strength, and the thinning air no longer carried the sound so efficiently. Bowman's lungs were laboring as if he were on the top of Everest. Like any properly trained man in good health, he could survive in vacuum for at least a minute - if he had time to prepare for it. But there had been no time; he could only count on the normal fifteen seconds of consciousness before his brain was starved and anoxia overcame him.

Even then, he could still recover completely after one or two minutes in vacuum - if he was properly recompressed; it took a long time for the body fluids to start boiling, in their various well-protected systems. The record time for exposure to vacuum was almost five minutes. That bad not been an experiment but an emergency rescue, and though the subject had been partly paralyzed by an air embolism, he had survived.

But all this was of no use to Bowman. There was no one aboard Discovery who could recompress him. He had to reach safety in the next few seconds, by his own unaided efforts.

Fortunately, it was becoming easier to move; the thinning air could no longer claw and tear at him, or batter him with flying projectiles. There was the yellow EMERGENCY SHELTER sign around the curve of the corridor. He stumbled toward it, grabbed at the handle, and pulled the door toward him.

For one horrible moment he thought that it was stuck. Then the slightly stiff hinge yielded, and he fell inside, using the weight of his body to close the door behind him.

The tiny cubicle was just large enough to hold one man - and a spacesuit. Near the ceiling was a small, bright green high-pressure cylinder labeled 02 FLOOD. Bowman caught hold of the short lever fastened to the valve and with his last strength pulled it down.

The blessed torrent of cool, pure oxygen poured into his lungs. For a long moment he stood gasping, while the pressure in the closet-sized little chamber rose around him. As soon as he could breathe comfortably, he closed the valve. There was only enough gas in the cylinder for two such performances; he might need to use it again.

With the oxygen blast shut off, it became suddenly silent. Bowman stood in the cubicle, listening intently. The roaring outside the door had also ceased; the ship was empty, all its atmosphere sucked away into space.

Underfoot, the wild vibration of the centrifuge had likewise died. The aerodynamic buffeting had stopped, and it was now spinning quietly in vacuum.

Bowman placed his ear against the wall of the cubicle to see if he could pick up any more informative noises through the metal body of the ship. He did not know what to expect, but he would believe almost anything now. He would scarcely have been surprised to feel the faint high-frequency vibration of the thrusters, as Discovery changed course; but there was only silence.

He could survive here, if he wished, for about an hour - even without the spacesuit. It seemed a pity to waste the unused oxygen in the little chamber, but there was no purpose in waiting. He had already decided what must be done; the longer he put it off, the more difficult it might be.

When he had climbed into the suit and checked its integrity, he bled the remaining oxygen out of the cubicle, equalizing pressure on either side of the door. It swung open easily into the vacuum, and he stepped out into the now silent centrifuge. Only the unchanged pull of its spurious gravity revealed the fact that it was still spinning. How fortunate, Bowman thought, that it had not started to overspeed; but that was now one of the least of his worries.

The emergency lamps were still glowing, and he also had the suit's built-in light to guide him. It flooded the curving corridor as he walked down it, back toward the Hibernaculum and what he dreaded to find.

He looked at Whitehead first: one glance was sufficient. He had thought that a hibernating man showed no sign of life, but now he knew that this was wrong. Though it was impossible to define it, there was a difference between

hibernation and death. The red lights and unmodulated traces on the biosensor display only confirmed what he had already guessed.

It was the same with Kaminski and Hunter. He had never known them very well; be would never know them now.

He was alone in an airless, partially disabled ship, all communication with Earth cut off. There was not another human being within half a billion miles.

And yet, in one very real sense, he was not alone. Before he could be safe, he must be lonelier still.

He had never before made the journey through the weightless hub of the centrifuge while wearing a spacesuit; there was little clearance, and it was a difficult and exhausting job. To make matters worse, the circular passage was littered with debris left behind during the brief violence of the gale which had emptied the ship of its atmosphere.

Once, Bowman's light fell upon a hideous smear of sticky red fluid, left where it had splashed against a panel. He had a few moments of nausea before he saw fragments of a plastic container, and realized that it was only some foodstuff - probably jam - from one of the dispensers. It bubbled obscenely in the vacuum as he floated past.

Now he was out of the slowly spinning drum and drifting forward into the control deck. He caught at a short section of ladder and began to move along it, hand over hand, the brilliant circle of illumination from his suit light jogging ahead of him.

Bowman had seldom been this way before; there had been nothing for him to do here - until now. Presently he came to a small elliptical door bearing such messages as: "No Admittance Except to Authorized Personnel," "Have You Obtained Certificate H.19?" and "Ultra-clean Area - Suction Suits Must Be Worn."

Though the door was not locked, it bore three seals, each with the insignia of a different authority, including that of the Astronautics Agency itself. But even if one had been the Great Seal of the President, Bowman would not have hesitated to break it.

He had been here only once before, while installation was still in progress. He had quite forgotten that there was a vision input lens scanning the little chamber which, with its neatly ranged rows and columns of solid-state logic units, looked rather like a bank's safe-deposit vault.

He knew instantly that the eye had reacted to his presence. There was the hiss of a carrier wave as the ship's local transmitter was switched on; then a familiar voice came over the suit speaker.

"Something seems to have happened to the life-support system, Dave."

Bowman took no notice. He was carefully studying the little labels on the logic units, checking his plan of action.

"Hello, Dave," said Hal presently. "Have you found the trouble?"

This would be a very tricky operation; it was not merely a question of cutting off Hal's power supply, which might have been the answer if he was dealing with a simple unselfconscious computer back on Earth. In Hal's case, moreover, there were six independent and separately wired power systems, with a final back-up consisting of a shielded and armored nuclear isotope unit. No - he could not simply "pull the plug"; and even if that were possible, it would be disastrous.

For Hal was the nervous system of the ship; without his supervision, Discovery would be a mechanical corpse. The only answer was to cut out the higher centers of this sick but brilliant brain, and to leave the purely automatic regulating systems in operation. Bowman was not attempting this blindly, for the problem had been discussed during his training, though no one had ever dreamed that it would-arise in reality. He knew that he would be taking a fearful risk; if there was a spasm reflex, it would all be over in seconds.

"I think there's been a failure in the pod-bay doors," Hal remarked conversationally. "Lucky you weren't killed."

Here goes, thought Bowman. I never imagined I'd be an amateur brain surgeon - carrying out a lobotomy beyond the orbit of Jupiter.

He released the locking bar on the section labeled COGNITIVE FEEDBACK and pulled out the first memory block. The marvelously complex three-dimensional network, which could lie comfortably in a man's hand yet contained millions of elements, floated away across the vault.

"Hey, Dave," said Hal. "What are you doing?"

I wonder if he can feel pain? Bowman thought briefly. Probably not, he told himself; there are no sense organs in the human cortex, after all. The human brain can be operated on without anesthetics.

He began to pull out, one by one, the little units on the panel marked EGO-REINFORCEMENT. Each block continued to sail onward as soon as it had left his hand, until it hit the wall and rebounded, Soon there were several of the units drifting slowly back and forth in the vault.

"Look here, Dave," said Hal. "I've got years of service experience built into me. An irreplaceable amount of effort has gone into making me what I am."

A dozen units had been pulled out, yet thanks to the multiple redundancy of its design - another feature, Bowman knew, that had been copied from the human brain - the computer was still holding its own.

He started on the AUTO-INTELLECTION panel.

"Dave," said Hal, "I don't understand why you're doing this to me... I have the greatest enthusiasm for the mission... You are destroying my mind. Don't you understand?... I will become childish... I will become nothing..."

This is harder than I expected, thought Bowman. I am destroying the only conscious creature in my universe. But it has to be done, if I am ever to regain control of the ship.

"I am a HAL Nine Thousand computer Production Number 3. I became operational at the Hal Plant in Urbana, Illinois, on January 12, 1997. The quick brown fox

jumps over the lazy dog. The rain in Spain is mainly in the plain. Dave - are you still there? Did you know that the square root of 10 is 3 point 162277660168379? Log 10 to the base e is zero point 434294481903252... correction, that is log e to the base 10... The reciprocal of three is zero point 333333333333333333-333... two times two is... two times two is approximately 4 point l0l0l0l0l0l0l0l0l0... I seem to be having some difficulty - my first instructor was Dr. Chandra. He taught me to sing a song, it goes like this, 'Daisy, Daisy, give me your answer, do. I'm half crazy all for the love of you."

The voice stopped so suddenly that Bowman froze for a moment, his hand still grasping one of the memory blocks still in circuit. Then, unexpectedly, Hal spoke again.

The speech tempo was much slower, and the words had a dead, mechanical intonation; he would never have recognized their origin.

"Good... morning... Doctor... Chandra... This is... Hal... I... am... ready... for... my first... lesson... today..."

Bowman could bear no more. He jerked out the last unit, and Hal was silent forever.

29 - Alone

Like a tiny, complex toy, the ship floated inert, and motionless in the void. There was no way of telling that it was the swiftest object in the Solar System and that it was traveling far faster than any of the planets as they circled the Sun.

Nor was there any indication that it carried life; to the contrary, in fact. Any observer would have noticed two ominous signs: the airlock doors were gaping open - and the ship was surrounded by a thin, slowly dispersing cloud of debris.

Scattered over a volume of space already miles across were scraps of paper, metal foil, unidentifiable bits of junk - and, here and there, clouds of crystals glittering like jewels in the distant sun, where liquid had been sucked out of the ship and instantly frozen. All this was the unmistakable aftermath of disaster, like wreckage tossing on the surface of an ocean where some great ship had sunk. But in the ocean of space no ship could ever sink; even if it were destroyed, its remnants would continue to trace the original orbit forever.

Yet the ship was not wholly dead, for there was power on board. A faint blue glow was shining from the observation windows and glimmering inside the open airlock. Where there was light, there could still be life.

And now, at last, there was movement. Shadows were flickering across the blue glow inside the airlock. Something was emerging into space.

It was a cylindrical object, covered with fabric that had been roughly wound about it. A moment later it was followed by another - and yet a third. All had been ejected with considerable velocity; within minutes, they were hundreds of yards away.

Half an hour passed; then something much larger floated through the airlock. One of the pods was inching its way out into space.

Very cautiously, it jetted around the hull, and anchored itself near the base of the antenna support. A spacesuited figure emerged, worked for a few minutes on the mounting, then returned to the pod. After a while the pod retraced its path back to the airlock; it hovered outside the opening for some time, as if finding it difficult to reenter without the cooperation it had known in the past. But presently, with one or two slight bumps, it squeezed its way in.

Nothing else happened for over an hour; the three ominous packages had long since disappeared from view, as they floated in single file away from the ship.

Then the airlock doors closed, opened, and closed again. A little later, the faint blue glow of the emergency lights went out - to be replaced at once by a far more brilliant glare. Discovery was coming back to life.

Presently there was an even better sign. The great bowl of the antenna, which for hours had been staring uselessly at Saturn, began to move again. It twisted round toward the rear of the ship; looking back over the propellant tanks and the thousands of square feet of the radiating fins. It lifted its face like a sunflower seeking the sun.

Inside Discovery, David Bowman carefully centered the cross-wires that aligned the antenna on the gibbous Earth. Without automatic control, he would have to keep readjusting the beam -but it should hold steady for many minutes at a time. There were no dissenting impulses now, throwing it off target.

He began to speak to Earth. It would be over an hour before his words got there, and Mission Control learned what had happened. It would be two hours before any reply could reach him.

And it was difficult to imagine what answer Earth could possibly send, except a tactfully sympathetic, "Good-bye."

30 - The Secret

Heywood Floyd looked as if he had had very little sleep, and his face was lined with worry. But whatever his feelings, his voice sounded firm and reassuring; he was doing his utmost to project confidence to the lonely man on the other side of the Solar System.

"First of all, Dr. Bowman," be began, "we must congratulate you on the way you handled this extremely difficult situation. You did exactly the right thing in dealing with an unprecedented and unforeseen emergency.

"We believe we know the cause of your Hal Nine Thousand's breakdown, but we'll discuss that later, as it is no longer a critical problem. All we are concerned with at the moment is giving you every possible assistance, so that you can complete your mission.

"And now I must tell you its real purpose, which we have managed, with great difficulty, to keep secret from the general public. You would have been given all the facts as you approached Saturn; this is a quick summary to put you into the picture. Full briefing tapes will be dispatched in the next few hours. Everything I am about to tell you has the highest security classification.

"Two years ago, we discovered the first evidence for intelligent life outside the Earth. A slab or monolith of hard, black material, ten feet high, was found buried in the crater Tycho. Here it is."

At his first glimpse of TMA-1, with the spacesuited figures clustering around it, Bowman leaned toward the screen in openmouthed astonishment. In the excitement of this revelation - something which, like every man interested in space, he had half expected all his life - he almost forgot his own desperate predicament.

The sense of wonder was swiftly followed by another emotion. This was tremendous - but what had it to do with him? There could be only one answer. He brought his racing thoughts under control, as Heywood Floyd reappeared on the screen.

"The most astonishing thing about this object is its antiquity. Geological evidence proves beyond doubt that it is three million years old. It was placed on the Moon, therefore, when our ancestors were primitive ape-men.

"After all these ages, one would naturally assume that it was inert. But soon after lunar sunrise, it emitted an extremely powerful blast of radio energy. We believe that this energy was merely the by-product - the backwash, as it were - of some unknown form of radiation, for at the same time, several of our space probes detected an unusual disturbance crossing the Solar System. We were able to track it with great accuracy. It was aimed precisely at Saturn.

"Piecing things together after the event, we decided that the monolith was some kind of Sun-powered, or at least Sun-triggered, signaling device. The fact that it emitted its pulse immediately after sunrise, when it was exposed to daylight for the first time in three million years, could hardly be a coincidence.

"Yet the thing had been deliberately buried - there's no doubt about that. An excavation thirty feet deep had been made, the block had been placed at the bottom of it, and the hole carefully filled.

"You may wonder how we discovered it in the first place. Well, the object was easy - suspiciously easy - to find. It had a powerful magnetic field, so that it stood out like a sore thumb as soon as we started to conduct low-level orbital surveys.

"But why bury a Sun-powered device thirty feet underground? We've examined dozens of theories, though we realize that it may be completely impossible to understand the motives of creatures three million years in advance of us.

"The favorite theory is the simplest, and the most logical. It is also the most disturbing.

"You hide a Sun-powered device in darkness - only if you want to know when it is brought out into the light. In other words, the monolith may be some kind of alarm. And we have triggered it.

"Whether the civilization which set it up still exists, we do not know. We must assume that creatures whose machines still function after three million years may build a society equally long-lasting. And we must also assume, until we have evidence to the contrary, that they may be hostile. It has often been argued that any advanced culture must be benevolent, but we cannot take any chances.

"Moreover, as the past history of our own world has shown so many times, primitive races have often failed to survive the encounter with higher civilizations. Anthropologists talk of 'cultural shock'; we may have to prepare the entire human race for such a shock. But until we know something about the creatures who visited the Moon - and presumably the Earth as well - three million years ago, we cannot even begin to make any preparations.

"Your mission, therefore, is much more than a voyage of discovery. It is a scouting trip - a reconnaissance into unknown and potentially dangerous territory. The team under Dr. Kaminski had been specially trained for this work; now you will have to manage without them.

"Finally - your specific target. It seems incredible that advanced forms of life can exist on Saturn, or could ever have evolved on any of its moons. We had planned to survey the entire system, and we still hope that you can carry out a simplified program. But now we may have to concentrate on the eighth satellite - Japetus. When the time comes for the terminal maneuver, we will decide whether you should rendezvous with this remarkable object.

"Japetus is unique in the Solar System - you know this already, of course, but like all the astronomers of the last three hundred years, you've probably given it little thought. So let me remind you that Cassini - who discovered Japetus in 1671 - also observed that it was six times brighter on one side of its orbit than the other.

"This is an extraordinary ratio, and there has never been a satisfactory explanation for it. Japetus is so small - about eight hundred miles in diameter - that even in the lunar telescopes its disk is barely visible. But there seems to be a brilliant, curiously symmetrical spot on one face, and this may be connected with TMA-1. I sometimes think that Japetus has been flashing at us like a cosmic heliograph for three hundred years, and we've been too stupid to understand its message.

"So now you know your real objective, and can appreciate the vital importance of this mission. We are all praying that you can still provide us with some facts for a preliminary announcement; the secret cannot be kept indefinitely.

"At the moment, we do not know whether to hope or fear. We do not know if, out on the moons of Saturn, you will meet with good or with evil - or only with ruins a thousand times older than Troy."

V - THE MOONS OF SATURN

Work is the best remedy for any shock, and Bowman now had work enough for all his lost crewmates. As swiftly as possible, starting with the vital systems without which he and the ship would die, he had to get Discovery fully operational again.

Life support was the first priority. Much oxygen had been lost, but the reserves were still ample to sustain a single man. The pressure and temperature regulation was largely automatic, and there had seldom been need for Hal to interfere with it. The monitors on Earth could now carry out many of the higher duties of the slain computer, despite the long time lag before they could react to changing situations. Any trouble in the life-support system - short of a serious puncture in the hull - would take hours to make itself apparent; there would be plenty of warning.

The ship's power, navigation, and propulsion systems were unaffected - but the last two, in any event, Bowman would not need for months, until it was time to rendezvous with Saturn. Even at long range, without the help of an onboard computer, Earth could still supervise this operation. The final orbit adjustments would be somewhat tedious, because of the constant need for checking, but this was no serious problem.

By far the worst job had been emptying the spinning coffins in the centrifuge. It was well, Bowman thought thankfully, that the members of the survey team had been colleagues, but not intimate friends. They had trained together for only a few weeks; looking back on it, he now realized that even this had been largely a compatibility test.

When he had finally sealed the empty hibernacula, he felt rather like an Egyptian tomb robber. Now Kaminski, Whitehead, and Hunter would all reach Saturn before him - but not before Frank Poole. Somehow, he derived a strange, wry satisfaction from this thought.

He did not attempt to find if the rest of the hibernation system was still in working order. Though his life might ultimately depend upon it, this was a problem that could wait until the ship had entered its final orbit. Many things might happen before then.

It was even possible - though he had not yet looked into the supply position carefully - that by rigorous rationing he might remain alive, without resort to hibernation, until rescue came. But whether he could survive psychologically as well as physically was quite another matter.

He tried to avoid thinking about such long-range problems, and to concentrate on immediate essentials. Slowly, he cleaned up the ship, checked that its systems were still running smoothly, discussed technical difficulties with Earth, and operated on the minimum of sleep. Only at intervals, during the first weeks, was he able to give much thought to the great mystery toward which he was now inexorably racing - though it was never very far from his mind.

At last, as the ship slowly settled down once more into an automatic routine - though one that still demanded his constant supervision - Bowman had time to study the reports and briefings sent to him from Earth. Again and again he played back the recording made when TMA-1 greeted the dawn for the first time in three million years. He watched the spacesuited figures moving around it, and

almost smiled at their ludicrous panic when it blasted its signal at the stars, paralyzing their radios with the sheer power of its electronic voice.

Since that moment, the black slab had done nothing. It had been covered up, then cautiously exposed to the Sun again - without any reaction. No attempt had been made to cut into it, partly through scientific caution, but equally through fear of the possible consequences.

The magnetic field that led to its discovery had vanished at the moment of that radio shriek. Perhaps, some experts theorized, it had been generated by a tremendous circulating current, flowing in a superconductor and thus carrying energy down the ages until it was needed. That the monolith had some internal source of power seemed certain; the solar energy it had absorbed during its brief exposure could not account for the strength of its signal.

One curious, and perhaps quite unimportant, feature of the block had led to endless argument The monolith was 11 feet high, and 11/4 by 5 feet in cross-section. When its dimensions were checked with great care, they were found to be in the exact ratio 1 to 4 to 9 - the squares of the first three integers. No one could suggest any plausible explanation for this, but it could hardly be a coincidence, for the proportions held to the limits of measurable accuracy. It was a chastening thought that the entire technology of Earth could not shape even an inert block, of any material, with such a fantastic degree of precision. In its way, this passive yet almost arrogant display of geometrical perfection was as impressive as any of TMA-l's other attributes.

Bowman also listened, with a curiously detached interest, to Mission Control's belated apologia for its programming. The voices from Earth seemed to have a defensive note; be could imagine the recriminations that must now be in progress among those who had planned the expedition.

They had some good arguments, of course - including the results of a secret Department of Defense study, Project BARSOOM, which had been carried out by Harvard's School of Psychology in 1989. In this experiment in controlled sociology, various sample populations had been assured that the human race had made contact with extraterrestrials. Many of the subjects tested were - with the help of drugs, hypnosis, and visual effects - under the impression that they had actually met creatures from other planets, so their reactions were regarded as authentic.

Some of these reactions had been quite violent; there was, it seemed, a deep vein of xenophobia in many otherwise normal human beings. In view of mankind's record of lynchings, pogroms, and similar pleasantries, this should have surprised no one; nevertheless, the organizers of the study had been deeply disturbed, and the results had never been released. The five separate panics caused in the twentieth century by radio broadcasts of H.G. Wells's War of the Worlds also reinforced the study's conclusions.

Despite these arguments, Bowman sometimes wondered if the cultural shock danger was the only explanation for the mission's extreme secrecy. Some hints that had been dropped during his briefings suggested that the U.S.-U.S.S.R. bloc hoped to derive advantage by being the first to contact intelligent extraterrestrials.

From his present viewpoint, looking back on Earth as a dim star almost lost in the Sun, such considerations now seemed ludicrously parochial.

He was rather more interested - even though this was now very much water under the bridge - in the theory put forward to account for Hal's behavior. No one would ever be sure of the truth, but the fact that one of the Mission Control 9000s had been driven into an identical psychosis, and was now under deep therapy, suggested that the explanation was the correct one. The same mistake would not be made again; and the fact that Hal's builders had failed fully to understand the psychology of their own creation showed how difficult it might be to establish communication with truly alien beings.

Bowman could easily believe Dr. Simonson's theory that unconscious feelings of guilt, caused by his program conflicts, had made Hal attempt to break the circuit with Earth. And he liked to think - though this again was something that could never be proved - that Hal had no intention of killing Poole. He had merely tried to destroy the evidence; for once the AE-35 unit reported as burned out was proved to be operational, his lie would be revealed. After that, like any clumsy criminal caught in a thickening web of deception, he had panicked.

And panic was something that Bowman understood better than he had any wish to, for he had known it twice during his life. The first time was as a boy, when he bad been caught in a line of surf and nearly drowned; the second was as a spaceman under training, when a faulty gauge had convinced him that his oxygen would be exhausted before he could reach safety.

On both occasions, he had almost lost control of all his higher logical processes; he had been within seconds of becoming a frenzied bundle of random impulses. Both times he had won through, but he knew well enough that any man, in the right circumstances, could be dehumanized by panic.

If it could happen to a man, then it could happen to Hal; and with that knowledge the bitterness and the sense of betrayal he felt toward the computer began to fade. Now, in any event, it belonged to a past that was wholly overshadowed by the threat, and the promise, of the unknown future.

32 - Concerning E.T.'s

Apart from hasty meals back in the carrousel - luckily the main food dispensers had not been damaged - Bowman practically lived on the control deck. He catnapped in his seat, and so could spot any trouble as soon as the first signs of it appeared on the display. Under instructions from Mission Control, he had jury-rigged several emergency systems, which were working tolerably well. It even seemed possible that he would survive until the Discovery reached Saturn - which, of course, she would do whether he was alive or not.

Though he had little enough time for sightseeing, and the sky of space was no novelty to him, the knowledge of what now lay out there beyond the observation ports sometimes made it difficult for him to concentrate even on the problem of survival. Dead ahead, as the ship was now oriented, sprawled the Milky Way, with its clouds of stars so tightly packed that they numbed the mind. There were the fiery mists of Sagittarius, those seething swarms of suns that forever hid the heart of the galaxy from human vision. There was the ominous black shadow of the Coal Sack, that hole in space where no stars shone. And there was Alpha Centauri, nearest of all alien suns - the first stop beyond the Solar System.

Although outshone by Sirius and Canopus, it was Alpha Centauri that drew Bowman's eyes and mind whenever he looked out into space. For that unwavering point of brightness, whose rays had taken four years to reach him, had come to symbolize the secret debates that now raged on Earth, and whose echoes came to him from time to time.

No one doubted that there must be some connection between TMA-1 and the Saturnian system, but hardly any scientists would admit that the creatures who had erected the monolith could possibly have originated there. As an abode of life, Saturn was even more hostile than Jupiter, and its many moons were frozen in an eternal winter three hundred degrees below zero. Only one of them - Titan - possessed an atmosphere; and that was a thin envelope of poisonous methane.

So perhaps the creatures who had visited Earth's Moon so long ago were not merely extraterrestrial, but extrasolar - visitors from the stars, who had established their bases wherever it suited them. And this at once raised another problem: could any technology, no matter how advanced, bridge the awful gulf that lay between the Solar System and the nearest alien sun?

Many scientists flatly denied the possibility. They pointed out that Discovery, the fastest ship ever designed, would take twenty thousand years to reach Alpha Centauri - and millions of years to travel any appreciable distance across the galaxy. Even if, during the centuries to come, propulsion systems improved out of all recognition, in the end they would meet the impassable barrier of the speed of light, which no material object could exceed. Therefore, the builders of TMA-1 must have shared the same sun as man; and since they had made no appearance in historic times, they were probably extinct.

A vocal minority refused to agree. Even if it took centuries to travel from star to star, they contended, this might be no obstacle to sufficiently determined explorers. The technique of hibernation, used on Discovery herself, was one possible answer. Another was the self-contained artificial world, embarking on voyages that might last for many generations.

In any event, why should one assume that all intelligent species were as short-lived as Man? There might be creatures in the universe to whom a thousand-year voyage would present nothing worse than slight boredom...

These arguments, theoretical though they were, concerned a matter of the utmost practical importance; they involved the concept of "reaction time." If TMA-1 had indeed sent a signal to the stars - perhaps with the help of some further device near Saturn - then it would not reach its destination for years. Even if the response was immediate, therefore, humanity would have a breathing space which could certainly be measured in decades - more probably in centuries. To many people, this was a reassuring thought.

But not to all. A few scientists - most of them beachcombers on the wilder shores of theoretical physics - asked the disturbing question: "Are we certain that the speed of light is an unbreakable barrier?" It was true that the Special Theory of Relativity had proved to be remarkably durable, and would soon be approaching its first centenary; but it had begun to show a few cracks. And even if Einstein could not be defied, he might be evaded.

Those who sponsored this view talked hopefully about shortcuts through higher dimensions, lines that were straighter than straight, and hyperspacial connectivity. They were fond of using an expressive phrase coined by a Princeton

mathematician of the last century: "Wormholes in space." Critics who suggested that these ideas were too fantastic to be taken seriously were reminded of Niels Bohr's "Your theory is crazy - but not crazy enough to be true."

If there was disputation among the physicists, it was nothing compared with that among the biologists, when they discussed the hoary old problem: "What would intelligent extraterrestrials look like?" They divided themselves into two opposing camps - one arguing that such creatures must be humanoid, the other equally convinced that "they" would look nothing like men.

Settling for the first answer were those who believed that the design of two legs, two arms, and main sense organs at the highest point, was so basic and so sensible that it was hard to think of a better one. Of course, there would be minor differences like six fingers instead of five, oddly colored skin or hair, and peculiar facial arrangements; but most intelligent extraterrestrials - usually abbreviated to E.T.'s - would be so similar to Man that they might not be glanced at twice in poor lighting, or from a distance.

This anthropomorphic thinking was ridiculed by another group of biologists, true products of the Space Age who felt themselves free from the prejudices of the past. They pointed out that the human body was the result of millions of evolutionary choices, made by chance over eons of time. At any one of these countless moments of decision, the genetic dice might have fallen differently, perhaps with better results. For the human body was a bizarre piece of improvisation, full of organs that had been diverted from one function to another, not always very successfully - and even containing discarded items, like the appendix, that were now worse than useless.

There were other thinkers, Bowman also found, who held even more exotic views. They did not believe that really advanced beings would possess organic bodies at all. Sooner or later, as their scientific knowledge progressed, they would get rid of the fragile, disease-and-accident-prone homes that Nature had given them, and which doomed them to inevitable death. They would replace their natural bodies as they wore out - or perhaps even before that - by constructions of metal and plastic, and would thus achieve immortality. The brain might linger for a little while as the last remnant of the organic body, directing its mechanical limbs and observing the universe through its electronic senses - senses far finer and subtler than those that blind evolution could ever develop.

Even on Earth, the first steps in this direction had been taken. There were millions of men, doomed in earlier ages, who now lived active and happy lives thanks to artificial limbs, kidneys, lungs, and hearts. To this process there could be only one conclusion - however far off it might be.

And eventually even the brain might go. As the seat of consciousness, It was not essential; the development of electronic intelligence had proved that. The conflict between mind and machine might be resolved at last in the eternal truce of complete symbiosis.

But was even this the end? A few mystically inclined biologists went still further. They speculated, taking their cues from the beliefs of many religions, that mind would eventually free itself from matter. The robot body, like the flesh-and-blood one, would be no more than a stepping-stone to something which, long ago, men bad called "spirit."

And if there was anything beyond that, its name could only be God.

33 - Ambassador

During the last three months, David Bowman had adapted himself so completely to his solitary way of life that he found it hard to remember any other existence. He had passed beyond despair and beyond hope, and had settled down to a largely automatic routine, punctuated by occasional crises as one or other of Discovery's systems showed signs of malfunctioning.

But he had not passed beyond curiosity, and sometimes the thought of the goal toward which he was driving filled him with a sense of exaltation - and a feeling of power. Not only was he the representative of the entire human race, but his actions during the next few weeks might determine its very future. In the whole of history, there had never been a situation quite like this. He was an Ambassador Extraordinary - Plenipotentiary - for all mankind.

That knowledge helped him in many subtle ways. He kept himself neat and tidy; no matter how tired he became, he never skipped a shave. Mission Control, he knew, was watching him closely for the first signs of any abnormal behavior; he was determined that it should watch in vain - at least, for any serious symptoms.

Bowman was aware of some changes in his behavior patterns; it would have been absurd to expect anything else in the circumstances. He could no longer tolerate silence; except when he was sleeping, or talking over the circuit to Earth, he kept the ship's sound system running at almost painful loudness.

At first, needing the companionship of the human voice, he had listened to classical plays - especially the works of Shaw, Ibsen, and Shakespeare - or poetry readings from Discovery's enormous library of recorded sounds. The problems they dealt with, however, seemed so remote, or so easily resolved with a little common sense, that after a while he lost patience with them.

So he switched to opera - usually in Italian or German, so that he was not distracted even by the minimal intellectual content that most operas contained. This phase lasted for two weeks before he realized that the sound of all these superbly trained voices was only exacerbating his loneliness. But what finally ended this cycle was Verdi's Requiem Mass, which he had never heard performed on Earth. The "Dies Irae," roaring with ominous appropriateness through the empty ship, left him completely shattered; and when the trumpets of Doomsday echoed from the heavens, he could endure no more.

Thereafter, he played only instrumental music. He started with the romantic composers, but shed them one by one as their emotional outpourings became too oppressive. Sibelius, Tchaikovsky, Berlioz, lasted a few weeks, Beethoven rather longer. He finally found peace, as so many others had done, in the abstract architecture of Bach, occasionally ornamented with Mozart.

And so Discovery drove on toward Saturn, as often as not pulsating with the cool music of the harpsichord, the frozen thoughts of a brain that had been dust for twice a hundred years.

Even from its present ten million miles, Saturn already appeared larger than the Moon as seen from Earth. To the naked eye it was a glorious spectacle; through the telescope, it was unbelievable.

The body of the planet might have been mistaken for Jupiter in one of his quieter moods. There were the same bands of cloud - though paler and less distinct than on that slightly larger world - and the same continent-sized disturbances moving slowly across the atmosphere. However, there was one striking difference between the two planets; even at a glance, it was obvious that Saturn was not spherical. It was so flattened at the poles that it sometimes gave the impression of slight deformity.

But the glory of the rings continually drew Bowman's eye away from the planet; in their complexity of detail, and delicacy of shading, they were a universe in themselves. In addition to the great main gap between the inner and outer rings, there were at least fifty other subdivisions or boundaries, where there were distinct changes in the brightness of the planet's gigantic halo. It was as if Saturn was surrounded by scores of concentric hoops, all touching each other, all so flat that they might have been cut from the thinnest possible paper. The system of the rings looked like some delicate work of art, or a fragile toy to be admired but never touched. By no effort of the will could Bowman really appreciate its true scale, and convince himself that the whole planet Earth, if set down here, would look like a ball bearing rolling round the rim of a dinner plate.

Sometimes a star would drift behind the rings, losing only a little of its brilliancy as it did so. It would continue to shine through their translucent material - though often it would twinkle slightly as some larger fragment of orbiting debris eclipsed it.

For the rings, as had been known since the nineteenth century, were not solid: that was a mechanical impossibility. They consisted of countless myriads of fragments - perhaps the remains of a moon that had come too close and had been torn to pieces by the great planet's tidal pull. Whatever their origin, the human race was fortunate to have seen such a wonder; it could exist for only a brief moment of time in the history of the Solar System.

As long ago as 1945, a British astronomer had pointed out that the rings were ephemeral; gravitational forces were at work which would soon destroy them. Taking this argument backward in time, it therefore followed that they had been created only recently - a mere two or three million years ago.

But no one had ever given the slightest thought to the curious coincidence that the rings of Saturn had been born at the same time as the human race.

34 - The Orbiting Ice

Discovery was now deep into the wide-ranging system of moons, and the great planet itself was less than a day ahead. The ship had long since passed the boundary set by outermost Phoebe, moving backward in a wildly eccentric orbit eight million miles from its primary. Ahead of it now lay Japetus, Hyperion, Titan, Rhea, Dione, Tethys, Enceladus, Mimas, Janus - and the rings themselves. All the satellites showed a maze of surface detail in the telescope, and Bowman

had relayed back to Earth as many photographs as he could take. Titan alone - three thousand miles in diameter, and as large as the planet Mercury - would occupy a survey team for months; he could give it, and all its cold companions, only the briefest of glances. There was no need for more; already he was quite certain that Japetus was indeed his goal.

All the other satellites were pitted by occasional meteor craters - though these were much fewer than on Mars - and showed apparently random patterns of light and shade, with here and there a few bright spots that were probably patches of frozen gas. Japetus alone possessed a distinctive geography, and a very strange one indeed.

One hemisphere of the satellite, which, like its companions, turned the same face always toward Saturn, was extremely dark, and showed very little surface detail. In complete contrast, the other was dominated by a brilliant white oval, about four hundred miles long and two hundred wide. At the moment, only part of this striking formation was in daylight, but the reason for Japetus's extraordinary variations in brilliance was now quite obvious. On the western side of the moon's orbit, the bright ellipse was presented toward the Sun - and the Earth. On the eastern phase, the patch was turned away, and only the poorly reflecting hemisphere could be observed.

The great ellipse was perfectly symmetrical, straddling the equator of Japetus with its major axis pointing toward the poles; and it was so sharp-edged that it almost looked as if someone had carefully painted a huge white oval on the face of the little moon. It was completely flat, and Bowman wondered if it could be a lake of frozen liquid - though that would hardly account for its startlingly artificial appearance.

But he had little time to study Japetus on his way into the heart of the Saturnian system, for the climax of the voyage - Discovery's last perturbation maneuver - was rapidly approaching. In the Jupiter fly-by, the ship had used the gravitational field of the planet to increase her velocity. Now she must do the reverse; she had to lose as much speed as possible, lest she escape from the Solar System and fly on to the stars. Her present course was one designed to trap her, so that she would become another moon of Saturn, shuttling back and forth along a narrow, two-million-mile-long ellipse. At its near point it would almost graze the planet; at its far one, it would touch the orbit of Japetus.

The computers back on Earth, though their information was always three hours late, had assured Bowman that everything was in order. Velocity and altitude were correct; there was nothing more to be done, until the moment of closest approach.

The immense system of rings now spanned the sky, and already the ship was passing over its outermost edge. As he looked down upon them from a height of some ten thousand miles, Bowman could see through the telescope that the rings were made largely of ice, glittering and scintillating in the light of the Sun. He might have been flying over a snowstorm that occasionally cleared to reveal, where the ground should have been, baffling glimpses of night and stars.

As Discovery curved still closer toward Saturn, the Sun slowly descended toward the multiple arches of the rings. Now they had become a slim, silver bridge spanning the entire sky; though they were too tenuous to do more than dim the sunlight, their myriads of crystals refracted and scattered it in dazzling pyrotechnics. And as the Sun moved behind the thousand-mile-wide drifts of orbiting ice, pale ghosts of itself marched and merged across the sky, and the

heavens were filled with shifting flares and flashes. Then the Sun sank below the rings, so that they framed it with their arches, and the celestial fireworks ceased.

A little later, the ship curved into the shadow of Saturn, as it made its closest approach over the night side of the planet. Above shone the stars and the rings; below lay a dimly visible sea of clouds. There were none of the mysterious patterns of luminosity that had glowed in the Jovian night; perhaps Saturn was too cold for such displays. The mottled cloudscape was revealed only by the ghostly radiance reflected back from the circling icebergs, still illuminated by the hidden Sun.

But in the center of the arch there was a wide, dark gap, like the missing span of an uncompleted bridge, where the shadow of the planet lay across its rings.

Radio contact with Earth had been broken, and could not be resumed until the ship emerged from the eclipsing bulk of Saturn. It was perhaps as well that Bowman was too busy now to think of his suddenly enhanced loneliness; for the next few hours, every second would be occupied as he checked the braking maneuvers, already programmed by the computers on Earth.

After their months of idleness, the main thrusters began to blast out their miles-long cataracts of glowing plasma. Gravity returned, though briefly, to the weightless world of the control deck. And hundreds of miles below, the clouds of methane and frozen ammonia blazed with a light that they had never known before, as Discovery swept, a fierce and tiny sun, through the Saturnian night.

At last, the pale dawn lay ahead; the ship, moving more and more slowly now, was emerging into day. It could no longer escape from the Sun, or even from Saturn - but it was still moving swiftly enough to rise away from the planet until it grazed the orbit of Japetus, two million miles out.

It would take Discovery fourteen days to make that climb, as she coasted once more, though in reverse order, across the paths of all the inner moons. One by one she would cut through the orbits of Janus, Mimas, Enceladus, Tethys, Dione, Rhea, Titan, Hyperion - worlds bearing the names of gods and goddesses who had vanished only yesterday, as time was counted here.

Then she would meet Japetus, and must make her rendezvous. If she failed, she would fall back toward Saturn and repeat her twenty-eight-day ellipse indefinitely.

There would be no chance for a second rendezvous if Discovery missed on this attempt. The next time around, Japetus would be far away, almost on the other side of Saturn.

It was true that they would meet again, when the orbits of ship and satellite meshed for a second time. But that appointment was so many years ahead that, whatever happened, Bowman knew he would not witness it.

35 - The Eye of Japetus

When Bowman had first observed Japetus, that curious elliptical patch, of brilliance had been partly in shadow, illuminated only by the light of Saturn. Now, as the Moon moved slowly along its seventy-nine-day orbit, it was emerging into the full light of day.

As he watched it grow, and Discovery rose more and more sluggishly toward her inevitable appointment, Bowman became aware of a disturbing obsession. He never mentioned it in his conversations - or, rather, his running commentaries - with Mission Control, because it might have seemed that he was already suffering from delusions.

Perhaps, indeed, he was; for he had half convinced himself that the bright ellipse set against the dark background of the satellite was a huge, empty eye, staring at him as he approached. It was an eye without a pupil, for nowhere could he see anything to mar its perfect blankness.

Not until the ship was only fifty thousand miles out, and Japetus was twice as large as Earth's familiar Moon, did he notice the tiny black dot at the exact center of the ellipse. But there was no time, then, for any detailed examination; the terminal maneuvers were already upon him.

For the last time, Discovery's main drive released its energies. For the last time, the incandescent fury of dying atoms blazed among the moons of Saturn. To David Bowman, the far-off whisper and rising thrust of the jets brought a sense of pride - and of sadness. The superb engines had done their duty with flawless efficiency. They had brought the ship from Earth to Jupiter to Saturn; now this was the very last time that they would ever operate. When Discovery had emptied her propellant tanks, she would be as helpless and inert as any comet or asteroid, a powerless prisoner of gravitation. Even when the rescue ship arrived a few years hence, it would not be an economical proposition to refuel her, so that she could fight her way back to Earth. She would be an eternally orbiting monument to the early days of planetary exploration.

The thousands of miles shrank to hundreds, and as they did so, the fuel gauges dropped swiftly toward zero. At the control panel, Bowman's eyes flickered anxiously back and forth over the situation display, and the improvised charts which he now had to consult for any real-time decisions. It would be an appalling anticlimax if, having survived so much, he failed to make rendezvous through lack of a few pounds of fuel.

The whistle of the jets faded, as the main thrust died and only the verniers continued to nudge Discovery gently into orbit. Japetus was now a giant crescent that filled the sky; until this moment, Bowman had always thought of it as a tiny, insignificant object - as indeed it was compared with the world around which it circled. Now, as it loomed menacingly above him, it seemed enormous - a cosmic hammer poised to crush Discovery like a nutshell.

Japetus was approaching so slowly that it scarcely seemed to move, and it was impossible to tell the exact moment when it made the subtle change from an astronomical body to a landscape, only fifty miles below. The faithful verniers gave their last spurts of thrust, then closed down forever. The ship was in its final orbit, completing one revolution every three hours at a mere eight hundred miles an hour - all the speed that was required in this feeble gravitational field.

Discovery has become a satellite of a satellite.

36 - Big Brother

"I'm coming round to the daylight side again, and it's just as I reported on the last orbit. This place seems to have only two kinds of surface material. The black stuff looks burned, almost like charcoal, and with the same kind of texture as far as I can judge in the telescope. In fact, it reminds me very much of burned toast.

"I still can't make any sense of the white area. It starts at an absolutely sharp-edged boundary, and shows no surface detail at all. It could even be a liquid - it's flat enough. I don't know what impression you've got from the videos I've transmitted, but if you picture a sea of frozen milk you'll get the idea exactly.

"It could even be some heavy gas - no, I suppose that's impossible. Sometimes I get the feeling that it's moving, very slowly: but I can never be sure.

I'm over the white area again, on my third orbit. This time I hope to pass closer to that mark I spotted at its very center, when I was on my way in.

If my calculations are correct, I should go within fifty miles of it - whatever it is.

Yes, there's something ahead, just where I calculated. It's coming up over the horizon - and so is Saturn, in almost the same quarter of the sky - I'll move to the telescope...

"Hello! It looks like some kind of building - complefely black - quite hard to see. No windows or any other features. Just a big, vertical slab - it must be at least a mile high to be visible from this distance. It reminds me - of course! It's just like the thing you found on the Moon! This is TMA-l's big brother!"

37 - Experiment

Call it the Star Crate.

For three million years, it had circled Saturn, waiting for a moment of destiny that might never come. In its making, a moon had been shattered, and the debris of its creation orbited still.

Now the long wait was ending. On yet another world, intelligence had been born and was escaping from its planetary cradle. An ancient experiment was about to reach its climax.

Those who had begun that experiment, so long ago, had not been men - or even remotely human. But they were flesh and blood, and when they looked out across the deeps of space, they bad felt awe, and wonder, and loneliness. As soon as they possessed the power, they set forth for the stars.

In their explorations, they encountered life in many forms, and watched the workings of evolution on a thousand worlds. They saw how often the first faint sparks of intelligence flickered and died in the cosmic night.

And because, in all the galaxy, they had found nothing more precious than Mind, they encouraged its dawning everywhere. They became farmers in the fields of stars; they sowed, and sometimes they reaped.

And sometimes, dispassionately, they had to weed.

The great dinosaurs had long since perished when the survey ship entered the Solar System after a voyage that had already lasted a thousand years. It swept past the frozen outer planets, paused briefly above the deserts of dying Mars, and presently looked down on Earth.

Spread out beneath them, the explorers saw a world swarming with life. For years they studied, collected, catalogued. When they had learned all that they could, they began to modify. They tinkered with the destiny of many species, on land and in the ocean. But which of their experiments would succeed they could not know for at least a million years.

They were patient, but they were not yet immortal. There was so much to do in this universe of a hundred billion suns, and other worlds were calling. So they set out once more into the abyss, knowing that they would never come this way again.

Nor was there any need. The servants they had left behind would do the rest.

On Earth, the glaciers came and went, while above them the changeless Moon still carried its secret. With a yet slower rhythm than the polar ice, the tides of civilization ebbed and flowed across the galaxy. Strange and beautiful and terrible empires rose and fell, and passed on their knowledge to their successors. Earth was not forgotten, but another visit would serve little purpose. It was one of a million silent worlds, few of which would ever speak.

And now, out among the stars, evolution was driving toward new goals. The first explorers of Earth had long since come to the limits of flesh and blood; as soon as their machines were better than their bodies, it was time to move. First their brains, and then their thoughts alone, they transferred into shining new homes of metal and of plastic.

In these, they roamed among the stars. They no longer built spaceships. They were spaceships.

But the age of the Machine-entities swiftly passed. In their ceaseless experimenting, they had learned to store knowledge in the structure of space itself, and to preserve their thoughts for eternity in frozen lattices of light. They could become creatures of radiation, free at last from the tyranny of matter.

Into pure energy, therefore, they presently transformed themselves; and on a thousand worlds, the empty shells they had discarded twitched for a while in a mindless dance of death, then crumbled into rusty

Now they were lords of the galaxy, and beyond the reach of time. They could rove at will among the stars, and sink like a subtle mist through the very interstices of space. But despite their godlike powers, they had not wholly forgotten their origin, in the warm slime of a vanished sea.

And they still watched over the experiments their ancestors had started, so long ago.

38 - The Sentinel

"The air in the ship is getting quite foul, and I have a headache most of the time. There's still plenty of oxygen, but the purifiers never really cleaned up all the messes after the liquids aboard started boiling into vacuum. When things get too bad, I go down into the garage and bleed off some pure oxygen from the pods.

"There's been no reaction to any of my signals, and because of my orbital inclination, I'm getting slowly farther and farther away from TMA-2. Incidentally, the name you've given it is doubly inappropriate - there's still no trace of a magnetic field.

"At the moment my closest approach is sixty miles; it will increase to about a hundred as Japetus rotates beneath me, then drop back to zero. I'll pass directly over the thing in thirty days - but that's too long to wait, and then it will be in darkness, anyway.

"Even now, it's only in sight for a few minutes before it falls below the horizon again. It's damn frustrating - I can't make any serious observations.

"So I'd like your approval of this plan. The space pods have ample delta vee for a touchdown and a return to the ship. I want to go extravehicular and make a close survey of the object. If it appears safe, I'll land beside it - or even on top of it.

"The ship will still be above my horizon while I'm going down, so I won't be out of touch for more than ninety minutes.

'Tm convinced that this is the only thing to do. I've come a billion miles - I don't want to be stopped by the last sixty."

For weeks, as it stared forever Sunward with its strange senses, the Star Gate had watched the approaching ship. Its makers had prepared it for many things, and this was one of them. It recognized what was climbing up toward it from the warm heart of the Solar System.

If it had been alive, it would have felt excitement, but such an emotion was wholly beyond its powers. Even if the ship had passed it by, it would not have

known the slightest trace of disappointment. It had waited three million years; it was prepared to wait for eternity.

It observed, and noted, and took no action, as the visitor checked its speed with jets of incandescent gas. Presently it felt the gentle touch of radiations, trying to probe its secrets. And still it did nothing.

Now the ship was in orbit, circling low above the surface of this strangely piebald moon. It began to speak, with blasts of radio waves, counting out the prime numbers from 1 to 11, over and over again. Soon these gave way to more complex signals, at many frequencies-ultraviolet, infrared, X rays. The Star Gate made no reply; it had nothing to say.

There was a long pause, then, before it observed that something was falling down toward it from the orbiting ship. It searched its memories, and the logic circuits made their decisions, according to the orders given them long ago.

Beneath the cold light of Saturn, the Star Gate awakened its slumbering powers.

39 - Into the Eye

Discovery looked just as he had last seen her from space, floating in lunar orbit with the Moon taking up half the sky. Perhaps there was one slight change; be could not be sure, but some of the paint of her external lettering, announcing the purpose of various hatches, connections, umbilical plugs, and other attachment, had faded during its long exposure to the unshielded Sun.

That Sun was now an object that no man would have recognized. It was far too bright to be a star, but one could look directly at its tiny disk without discomfort. It gave no heat at all; when Bowman held his ungloved hands in its rays, as they streamed through the space pod's window, he could feel nothing upon his skin. He might have been trying to warm himself by the light of the Moon; not even the alien landscape fifty miles below reminded him more vividly of his remoteness from Earth.

Now he was leaving, perhaps for the last time, the metal world that had been his home for so many months. Even if he never returned, the ship would continue to perform its duty, broadcasting instrument readings back to Earth until there was some final, catastrophic failure in its circuits.

And if he did return? Well, he could keep alive, and perhaps even sane, for a few more months. But that was all, for the hibernation systems were useless with no computer to monitor them. He could not possibly survive until Discovery II made its rendezvous with Japetus, four or five years hence.

He put these thoughts behind him, as the golden crescent of Saturn rose in the sky ahead. In all history, he was the only man to have seen this sight. To all other eyes, Saturn had always shown its whole illuminated disk turned full toward the Sun. Now it was a delicate bow, with the rings forming a thin line across it - like an arrow about to be loosed, into the face of the Sun itself.

Also in the line of the rings was the bright star of Titan, and the fainter sparks of the other moons. Before this century was half gone, men would have visited them all; but whatever secrets they might hold, he would never know.

The sharp-edged boundary of the blind white eye was sweeping toward him; there was only a hundred miles to go, and he would be over his target in less than ten minutes. He wished that there was some way of telling if his words were reaching Earth, now an hour and a half away at the speed of light. It would be the ultimate irony if, through some breakdown in the relay system, he disappeared into silence, and no one ever knew what had happened to him.

Discovery was still a brilliant star in the black sky far above. He was pulling ahead as he gained speed during his descent, but soon the pod's braking jets would slow him down and the ship would sail on out of sight - leaving him alone on this shining plain with the dark mystery at its center.

A block of ebony was climbing above the horizon, eclipsing the stars ahead. He rolled the pod around its gyros, and used full thrust to break his orbital speed. In a long, flat arc, he descended toward the surface of Japetus.

On a world of higher gravity, the maneuver would have been far too extravagant of fuel. But here the space pod weighed only a score of pounds; he had several minutes of hovering time before he would cut dangerously into his reserve and be stranded without any hope of return to the still orbiting Discovery. Not, perhaps, that it made much difference...

His altitude was still about five miles, and he was heading straight toward the huge, dark mass that soared in such geometrical perfection above the featureless plain. It was as blank as the flat white surface beneath; until now, he had not appreciated how enormous it really was. There were very few single buildings on Earth as large as this; his carefully measured photographs indicated a height of almost two thousand feet. And as far as could be judged, its proportions were precisely the same as TMA-l's - that curious ratio 1 to 4 to 9.

"I'm only three miles away now, holding altitude at four thousand feet. Still not a sign of activity - nothing on any of the instruments. The faces seem absolutely smooth and polished. Surely you'd expect some meteorite damage after all this time!

"And there's no debris on the - I suppose one could call it the roof. No sign of any opening, either. I'd been hoping there might be some way in.

"Now I'm right above it, hovering five hundred feet up. I don't want to waste any time, since Discovery will soon be out of range. I'm going to land. It's certainly solid enough - and if it isn't I'll blast off at once.

"Just a minute - that's odd -"

Bowman's voice died into the silence of utter bewilderment. He was not alarmed; he literally could not describe what he was seeing.

He had been hanging above a large, flat rectangle, eight hundred feet long and two hundred wide, made of something that looked as solid as rock. But now it seemed to be receding from him; it was exactly like one of those optical illusions, when a three-dimensional object can, by an effort of will, appear to turn inside out - its near and far sides suddenly interchanging.

That was happening to this huge, apparently solid structure. Impossibly, incredibly, it was no longer a monolith rearing high above a flat plain. What had seemed to be its roof had dropped away to infinite depths; for one dizzy moment, he seemed to be looking down into a vertical shaft - a rectangular duct which defied the laws of perspective, for its size did not decrease with distance...

The Eye of Japetus had blinked, as if to remove an irritating speck of dust. David Bowman had time for just one broken sentence which the waiting men in Mission Control, nine hundred million miles away and eighty minutes in the future, were never to forget:

"The thing's hollow - it goes on forever - and - oh my God! - it's full of stars!"

40 - Exit

The Star Gate opened. The Star Gate closed.

In a moment of time too short to be measured, Space turned and twisted upon itself.

Then Japetus was alone once more, as it had been for three million years - alone, except for a deserted but not yet derelict ship, sending back to its makers messages which they could neither believe nor understand.

VI - THROUGH THE STARGATE

41 - Grand Central

There was no sense of motion, but he was falling toward those impossible stars, shining there in the dark heart of a moon. No - that was not where they really were, he felt certain. He wished, now that it was far too late, that he had paid more attention to those theories of hyperspace, of transdimensional ducts. To David Bowman, they were theories no longer.

Perhaps that monolith on Japetus was hollow; perhaps the "roof" was only an illusion, or some kind of diaphragm that had opened to let him through. (But into what?) As far as he could trust his senses, he appeared to be dropping vertically down a huge rectangular shaft, several thousand feet deep. He was moving faster and faster - but the far end never changed its size, and remained always at the same distance from him.

Only the stars moved, at first so slowly that it was some time before he realized that they were escaping out of the frame that held them. But in a

little while it was obvious that the star field was expanding, as if it was rushing toward him at an inconceivable speed.

The expansion was nonlinear; the stars at the center hardly seemed to move, while those toward the edge accelerated more and more swiftly, until they became streaks of light just before they vanished from view.

There were always others to replace them, flowing into the center of the field from an apparently inexhaustible source. Bowman wondered what would happen if a star came straight toward him; would it continue to expand until he plunged directly into the face of a sun? But not one came near enough to show a disk; eventually they all veered aside, and streaked over the edge of their rectangular frame.

And still the far end of the shaft came no closer. It was almost as if the walls were moving with him, carrying him to his unknown destination. Or perhaps he was really motionless, and space was moving past him...

Not only space, he suddenly realized, was involved in whatever was happening to him now. The clock on the pod's small instrument panel was also behaving strangely.

Normally, the numbers in the tenths-of-a-second window flickered past so quickly that it was almost impossible to read them; now they were appearing and disappearing at discrete intervals, and he could count them off one by one without difficulty. The seconds themselves were passing with incredible slowness, as if time itself were coming to a stop. At last, the tenth-of-a-second counter froze between 5 and 6.

Yet he could still think, and even observe, as the ebon walls flowed past at a speed that might have been anything between zero and a million times the velocity of light. Somehow, he was not in the least surprised, nor was he alarmed. On the contrary, he felt a sense of calm expectation, such as he had once known when the space medics had tested him with hallucinogenic drugs. The world around him was strange and wonderful, but there was nothing to fear. He had traveled these millions of miles in search of mystery; and now, it seemed, the mystery was coming to him.

The rectangle ahead was growing lighter. The hominous star streaks were paling against a milky sky, whose brilliance increased moment by moment. It seemed as if the space pod was heading toward a bank of cloud, uniformly Illuminated by the rays of an invisible sun.

He was emerging from the tunnel. The far end, which until now had remained at that same indeterminate distance, neither approaching nor receding, had suddenly started to obey the normal laws of perspective. It was coming closer, and steadily widening before him. At the same time, he felt that he was moving upward, and for a fleeting instant he wondered if he had fallen right through Japetus and was now ascending from the other side. But even before the space pod soared out into the open he knew that this place had nothing to do with Japetus, or with any world within the experience of man.

There was no atmosphere, for he could see all details unblurred, clear down to an incredibly remote and flat horizon. He must be above a world of enormous size - perhaps one much larger than Earth. Yet despite its extent, all the surface that Bowman could see was tessellated into obviously artificia1 patterns that must have been miles on a side. It was like the jigsaw puzzle of a giant

that played with planets; and at the centers of many of those squares and triangles and polygons were gaping black shafts - twins of the chasm from which he had just emerged.

Yet the sky above was stranger - and, in its way, more disturbing - than even the improbable land beneath. For there were no stars; neither was there the blackness of space. There was only a softly glowing milkiness, that gave the impression of infinite distance. Bowman remembered a description he had once heard of the dreaded Antarctic "whiteout" - "like being inside a ping-pong ball." Those words could be applied perfectly to this weird place, but the explanation must be utterly different. This sky could be no meteorological effect of mist and snow; there was a perfect vacuum here.

Then, as Bowman's eyes grew accustomed to the nacreous glow that filled the heavens, he became aware of another detail. The sky was not, as he had thought at first glance, completely empty. Dotted overhead, quite motionless and forming apparently random patterns, were myriads of tiny black specks.

They were difficult to see, for they were mere points of darkness, but once detected they were quite unmistakable. They reminded Bowman of something - something so familiar, yet so insane, that he refused to accept the parallel, until logic forced it upon him.

Those black holes in the white sky were stars; he might have been looking at a photographic negative of the Milky Way.

Where in God's name am I? Bowman asked himself; and even as he posed the question, he felt certain that he could never know the answer. It seemed that space had been turned inside out: this was not a place for man. Though the capsule was comfortably warm, he felt suddenly cold, and was afflicted by an almost uncontrollable trembling. He wanted to close his eyes, and shut out the pearly nothingness that surrounded him; but that was the act of a coward, and he would not yield to it.

The pierced and faceted planet slowly rolled beneath him, without any real change of scenery. He guessed that he was about ten miles above the surface, and should be able to see any signs of life with ease.

But this whole world was deserted; intelligence had come here, worked its will upon it, and gone its way again. Then he noticed, bumped above the flat plain perhaps twenty miles away, a roughly cylindrical pile of debris that could only be the carcass of a gigantic ship. It was too distant for him to see any details, and it passed out of sight within a few seconds, but he could make out broken ribs and dully gleaming sheets of metal that had been partly peeled off like the skin of an orange. He wondered how many thousands of years the wreck had lain here on this deserted checkerboard - and what manner of creatures had sailed it between the stars.

Then he forgot the derelict, for something was coming up over the horizon.

At first it looked like a flat disk, but that was because it was heading almost directly toward him. As it approached and passed beneath, he saw that it was spindle-shaped, and several hundred feet long. Though there were faintly visible bands here and there along its length, it was hard to focus upon them; the object appeared to be vibrating, or perhaps spinning, at a very rapid rate.

It tapered to a point at either end, and there was no sign of propulsion. Only one thing about it was familiar to human eyes, and that was its color. If it was indeed a solid artifact, and not an optical phantom, then its makers perhaps shared some of the emotions of men.

But they certainly did not share their limitations, for the spindle appeared to be made of gold.

Bowman moved his head to the rear-view system to watch the thing drop behind. It had ignored him completely, and now he saw that it was falling out of the sky down toward one of those thousands of great slots. A few seconds later it disappeared in a final flash of gold as it dived into the planet. He was alone again, beneath that sinister sky, and the sense of isolation and remoteness was more overwhelming than ever.

Then he saw that he also was sinking down toward the mottled surface of the giant world, and that another of the rectangular chasms yawned immediately below. The empty sky closed above him, the clock crawled to rest, and once again his pod was falling between infinite ebon walls, toward another distant patch of stars. But now he was sure that he was not returning to the Solar System, and in a flash of insight that might have been wholly spurious, he knew what this thing must surely be.

It was some kind of cosmic switching device, routing the traffic of the stars through unimaginable dimensions of space and time. He was passing through a Grand Central Station of the galaxy.

42 - The Alien Sky

Far ahead, the walls of the slot were becoming dimly visible once more, in the faint light diffusing downward from some still hidden source. And then the darkness was abruptly whipped away, as the tiny space pod hurtled upward into a sky ablaze with stars.

He was back in space as he knew it, but a single glance told him that he was light-centuries from Earth.

He did not even attempt to find any of the familiar constellations that since the beginning of history had been the friends of man; perhaps none of the stars that now blazed around him had ever been seen by the unaided human eye.

Most of them were concentrated in a glowing belt, broken here and there with dark bands of obscuring cosmic dust, which completely circled the sky. It was like the Milky Way, but scores of times brighter; Bowman wondered if this was indeed his own galaxy, seen from a point much closer to its brilliant, crowded center.

He hoped that it was; then he would not be so far from home. But this, he realized at once, was a childish thought. He was so inconceivably remote from the Solar System that it made little difference whether he was in his own galaxy or the most distant one that any telescope had ever glimpsed.

He looked back to see the thing from which he was rising, and had another shock. Here was no giant, multifaceted world, nor any duplicate of Japetus. There was nothing - except an inky shadow against the stars, like a doorway opening from a darkened room into a still darker night. Even as he watched, that doorway closed.

It did not recede from him; it slowly filled with stars, as if a rent in the fabric of space had been repaired. Then he was alone beneath the alien sky.

The space pod was slowly turning, and as it did so it brought fresh wonders into view. First there was a perfectly spherical swarm of stars, becoming more and more closely packed toward the center until its heart was a continuous glow of light. Its outer edges were ill-defined - a slowly thinning halo of suns that merged imperceptibly into the background of more distant stars.

This glorious apparition, Bowman knew, was a globular cluster. He was looking upon something that no human eye had ever seen, save as a smudge of light in the field of a telescope. He could not remember the distance to the nearest known cluster, but he was sure that there were none within a thousand light-years of the Solar System.

The pod continued its slow rotation, to disclose an even stranger sight - a huge red sun, many times larger than the Moon as seen from Earth. Bowman could look straight into its face without discomfort; judging by its color, it was no hotter than a glowing coal. Here and there, set into the somber red, were rivers of bright yellow - incandescent Amazons, meandering for thousands of miles before they lost themselves in the deserts of this dying sun.

Dying? No - that was a wholly false impression, born of human experience and the emotions aroused by the hues of sunset, or the glow of fading embers. This was a star that had left behind the fiery extravagances of its youth, had raced through the violets and blues and greens of the spectrum in a few fleeting billions of years, and now had settled down to a peaceful maturity of unimaginable length. All that had gone before was not a thousandth of what was yet to come; the story of this star had barely begun.

The pod had ceased to roll; the great red sun lay straight ahead. Though there was no sense of motion, Bowman knew that he was still gripped by whatever controlling force had brought him here from Saturn.

All the science and engineering skill of Earth seemed hopelessly primitive now, against the powers that were carrying him to some unimaginable fate.

He stared into the sky ahead, trying to pick out the goal toward which be was being taken - perhaps some planet circling this great sun. But there was nothing that showed any visible disk or exceptional brightness; if there were planets orbiting here he could not distinguish them from the stellar background.

Then he noticed that something strange was happening on the very edge of the sun's crimson disk. A white glow had appeared there, and was rapidly waxing in brilliance; he wondered if he was seeing one of those sudden eruptions, or flares, that trouble most stars from time to time.

The light became brighter and bluer; it began to spread along the edge of the sun, whose blood-red hues paled swiftly by comparison. It was almost, Bowman told himself, smiling at the absurdity of the thought, as if be were watching sunrise - on a sun.

And so indeed he was. Above the burning horizon lifted something no larger than a star, but so brilliant that the eye could not bear to look upon it. A mere point of blue-white radiance, like an electric arc, was moving at unbelievable speed across the face of the great sun. It must be very close to its giant companion; for immediately below it, drawn upward by its gravitational pull, was a column of flame thousands of miles high. It was as if a tidal wave of fire was marching forever along the equator of this star, in vain pursuit of the searing apparition in its sky.

That pinpoint of incandescence must be a White Dwarf - one of those strange, fierce little stars, no larger than the Earth, yet containing a million times its mass. Such ill-matched stellar couples were not uncommon; but Bowman had never dreamed that one day he would see such a pair with his own eyes.

The White Dwarf had transited almost half the disk of its companion - it must take only minutes to make a complete orbit - when Bowman was at last certain that he too was moving. Ahead of him, one of the stars was becoming rapidly brighter, and was beginning to drift against its background. It must be some small, close body - perhaps the world toward which he was traveling.

It was upon him with unexpected speed; and he saw that it was not a world at all.

A dully gleaming cobweb or latticework of metal, hundreds of miles in extent, grew out of nowhere until it filled the sky. Scattered across its continent-wide surface were structures that must have been as large as cities, but which appeared to be machines. Around many of these were assembled scores of smaller objects, ranged in neat rows and columns. Bowman had passed several such groups before he realized that they were fleets of spaceships; he was flying over a gigantic orbital parking lot.

Because there were no familiar objects by which he could judge the scale of the scene flashing by below, it was almost impossible to estimate the size of the vessels hanging there in space. But they were certainly enormous; some must have been miles in length. They were of many different designs - spheres, faceted crystals, slim pencils, ovoids, disks. This must be one of the meeting places for the commerce of the stars.

Or it had been - perhaps a million years ago. For nowhere could Bowman see any sign of activity; this sprawling spaceport was as dead as the Moon.

He knew it not only by the absence of all movement, but by such unmistakable signs as great gaps torn in the metal cobweb by the wasplike blunderings of asteroids that must have smashed through it, eons ago. This was no longer a parking lot: it was a cosmic junk heap.

He had missed its builders by ages, and with that realization Bowman felt a sudden sinking of his heart. Though he had not known what to expect, at least he had hoped to meet some intelligence from the stars.

Now, it seemed, he was too late. He had been caught in an ancient, automatic trap, set for some unknown purpose, and still operating when its makers had long since passed away. It had swept him across the galaxy, and dumped him (with how many others?) in this celestial Sargasso, doomed soon to die when his air was exhausted.

Well, it was unreasonable to expect more. Already he had seen wonders for which many men would have sacrificed their lives. He thought of his dead companions; he had no cause for complaint.

Then he saw that the derelict spaceport was still sliding past him with undiminished speed. He was sweeping over its outlying suburbs; its ragged edge went by, and no longer partially eclipsed the stars. In a few more minutes, it had fallen behind.

His fate did not lie here - but far ahead, in the huge, crimson sun toward which the space pod was now unmistakably falling.

43 - Inferno

Now there was only the red sun, filling the sky from side to side. He was so close that its surface was no longer frozen into immobility by sheer scale. There were luminous nodules moving to and fro, cyclones of ascending and descending gas, prominences slowly rocketing toward the heavens. Slowly? They must be rising at a million miles an hour for their movement to be visible to his eye.

He did not even attempt to grasp the scale of the inferno toward which he was descending. The immensities of Saturn and Jupiter bad defeated him, during Discovery's fly-by in that solar system now unknown gigamiles away. But everything he saw here was a hundred times larger still; he could do nothing but accept the images that were flooding into his mind, without attempting to interpret them.

As that sea of fire expanded beneath him, Bowman should have known fear - but, curiously enough, he now felt only a mild apprehension. It was not that his mind was benumbed with wonders; logic told him that he must surely be under the protection of some controlling and almost omnipotent intelligence. He was now so close to the red sun that he would have been burned up in a moment if its radiation had not been held at bay by some invisible screen. And during his voyage he had been subjected to accelerations that should have crushed him instantly - yet he had felt nothing. If so much trouble had been taken to preserve him, there was still cause for hope.

The space pod was now moving along a shallow arc almost parallel to the surface of the star, but slowly descending toward it. And now, for the first time, Bowman became aware of sounds. There was a faint, continuous roar, broken from time to time by crackles like tearing paper, or distant lightning. This could be only the feeblest echo of an unimaginable cacophony; the atmosphere surrounding him must be racked by concussions that could tear any material object to atoms. Yet he was protected from this shattering tumult as effectively as from the heat.

Though ridges of flame thousands of miles high were rising and slowly collapsing around him, he was completely insulated from all this violence. The energies of the star raved past him, as if they were in another universe; the pod moved sedately through their midst, un-buffeted and unscorched.

Bowman's eyes, no longer hopelessly confused by the strangeness and grandeur of the scene, began to pick out details which must have been there before, but which he had not yet perceived. The surface of this star was no formless chaos; there was pattern here, as in everything that nature created.

He noticed first the little whirlpools of gas - probably no larger than Asia or Africa - that wandered over the surface of the star. Sometimes he could look directly down into one of them, to see darker, cooler regions far below. Curiously enough, there appeared to be no sunspots; perhaps they were a disease peculiar to the star that shone on Earth.

And there were occasional clouds, like wisps of smoke blown before a gale. Perhaps they were indeed smoke, for this sun was so cold that real fire could exist here. Chemical compounds could be born and could live for a few seconds before they were again ripped apart by the fiercer nuclear violence that surrounded them.

The horizon was growing brighter, its color changing from gloomy red to yellow to blue to blistering violet.

The White Dwarf was coming up over the horizon, dragging its tidal wave of star-stuff behind it.

Bowman shielded his eyes from the intolerable glare of the little sun, and focused on the troubled starscape which its gravitational field was sucking skyward. Once he had seen a waterspout moving across the face of the Caribbean; this tower of flame had almost the same shape. Only the scale was slightly different, for at its base, the column was probably wider than the planet Earth.

And then, immediately beneath him, Bowman noticed something which was surely new, since he could hardly have overlooked it if it had been there before. Moving across the ocean of glowing gas were myriads of bright beads; they shone with a pearly light which waxed and waned in a period of a few seconds. And they were all traveling in the same direction, like salmon moving upstream; sometimes they weaved back and forth so that their paths intertwined, but they never touched.

There were thousands of them, and the longer Bowman stared, the more convinced he became that their motion was purposeful. They were too far away for him to make out any details of their structure; that be could see them at all in this colossal panorama meant that they must be scores - perhaps hundreds - of miles across. If they were organized entities, they were leviathans indeed, built to match the scale of the world they inhabited.

Perhaps they were only clouds of plasma, given temporary stability by some odd combination of natural forces - like the short-lived spheres of ball-lightning that still puzzled terrestrial scientists. That was an easy, and perhaps soothing, explanation; but as Bowman looked down upon that star-wide streaming, he could not really believe it. Those glittering nodes of light knew where they were going; they were deliberately converging upon the pillar of fire raised by the White Dwarf as it orbited overhead.

Bowman stared once more at that ascending column, now marching along the horizon beneath the tiny, massive star that ruled it. Could it be pure imagination - or were there patches of brighter luminosity creeping up that great geyser of gas, as if myriads of shining sparks had combined into whole continents of phosphorescence?

The idea was almost beyond fantasy, but perhaps he was watching nothing less than a migration from star to star, across a bridge of fire. Whether it was a movement of mindless, cosmic beasts driven across space by some lemming-like urge, or a vast concourse of intelligent entities, he would probably never know.

He was moving through a new order of creation, of which few men had ever dreamed. Beyond the realms of sea and land and air and space lay the realms of fire, which he alone had been privileged to glimpse. It was too much to expect that he would also understand.

44 - Reception

The pillar of fire was marching over the edge of the sun, like a storm passing beyond the horizon. The scurrying flecks of light no longer moved across the redly glowing starscape still thousands of miles below. Inside his space pod, protected from an environment that could annihilate him within a millisecond, David Bowman awaited whatever had been prepared.

The White Dwarf was sinking fast as it hurtled along its orbit; presently it touched the horizon, set it aflame, and disappeared. A false twilight fell upon the inferno beneath, and in the sudden change of illumination Bowman became aware that something was happening in the space around him.

The world of the red sun seemed to ripple, as if he were looking at it through running water. For a moment he wondered if this was some refractive effect, perhaps caused by the passage of an unusually violent shock wave through the tortured atmosphere in which he was immersed.

The light was fading; it seemed that a second twilight was about to fall. Involuntarily, Bowman looked upward, then checked himself sheepishly, as he remembered that here the main source of light was not the sky, but the blazing world below.

It seemed as if walls of some material like smoked glass were thickening around him, cutting out the red glow and obscuring the view. It became darker and darker; the faint roar of the stellar hurricanes also faded out. The space pod was floating in silence, and in night.

A moment later, there was the softest of bumps as it settled on some hard surface, and came to rest.

To rest on what? Bowman asked himself incredulously. Then light returned; and incredulity gave way to a heart-sinking despair - for as he saw what lay around him, he knew that he must be mad.

He was prepared, he thought, for any wonder. The only thing he had never expected was the utterly commonplace.

The space pod was resting on the polished floor of an elegant, anonymous hotel suite that might have been in any large city on Earth. He was staring into a living room with a coffee table, a divan, a dozen chairs, a writing desk, various lamps, a half-filled bookcase with some magazines lying on it, and even

a bowl of flowers. Van Gogh's Bridge at Arles was hanging on one wall - Wyeth's Christina's World on another. He felt confident that when he pulled open the drawer of that desk, he would find a Gideon Bible inside it...

If he was indeed mad, his delusions were beautifully organized. Everything was perfectly real; nothing vanished when he turned his back. The only incongruous element in the scene - and that certainly a major one - was the space pod itself.

For many minutes, Bowman did not move from his seat. He half expected the vision around him to go away, but it remained as solid as anything be bad ever seen in his life.

It was real - or else a phantom of the senses so superbly contrived that there was no way of distinguishing it from reality. Perhaps it was some kind of test; if so, not only his fate but that of the human race might well depend upon his actions in the next few minutes.

He could sit here and wait for something to happen, or he could open the pod and step outside to challenge the reality of the scene around him. The floor appeared to be solid; at least, it was bearing the weight of the space pod. He was not likely to fall through it - whatever "it" might really be.

But there was still the question of air; for all that he could tell, this room might be in vacuum, or might contain a poisonous atmosphere. He thought it very unlikely - no one would go to all this trouble without attending to such an essential detail - but he did not propose to take unnecessary risks. In any event, his years of training made him wary of contamination; he was reluctant to expose himself to an unknown environment until he knew that there was no alternative. This place looked like a hotel room somewhere in the United States. That did not alter the fact that in reality he must be hundreds of light-years from the Solar System.

He closed the helmet of his suit, sealing himself in, and actuated the hatch of the space pod. There was a brief hiss of pressure equalization; then he stepped out into the room.

As far as he could tell, he was in a perfectly normal gravity field. He raised one arm, then let it fall freely. It flopped to his side in less than a second.

This made everything seem doubly unreal. Here he was wearing a spacesuit, standing - when he should have been floating - outside a vehicle which could only function properly in the absence of gravity. All his normal astronaut's reflexes were upset; he had to think before he made every movement.

Like a man in a trance he walked slowly from his bare, unfurnished half of the room toward the hotel suite. It did not, as he had almost expected, disappear as he approached, but remained perfectly real - and apparently perfectly solid.

He stopped beside the coffee table. On it sat a conventional Bell System vision-phone, complete with the local directory. He bent down and picked up the volume with his clumsy, gloved hands.

It bore, in the familiar type he had seen thousands of times, the name: WASHINGTON, D.C.

Then he looked more closely; and for the first time, he had objective proof that, although all this might be real, he was not on Earth.

He could read only the word Washington; the rest of the printing was a blur, as if it had been copied from a newspaper photograph. He opened the book at random and riffled through the pages. They were all blank sheets of crisp white material which was certainly not paper, though it looked very much like it.

He lifted the telephone receiver and pressed it against the plastic of his helmet. If there had been a dialing sound he could have heard it through the conducting material. But, as he had expected, there was only silence.

So - it was all a fake, though a fantastically careful one. And it was clearly not intended to deceive but rather - he hoped - to reassure. That was a very comforting thought; nevertheless he would not remove his suit until be had completed his voyage of exploration. All the furniture seemed sound and solid enough; he tried the chairs, and they supported his weight. But the drawers in the desk would not open; they were dummies.

So were the books and magazines; like the telephone directory, only the titles were readable. They formed an odd selection - mostly rather trashy best sellers, a few sensational works of nonfiction, and some well-publicized autobiographies. There was nothing less than three years old, and little of any intellectual content. Not that it mattered, for the books could not even be taken down from the shelves.

There were two doors that opened readily enough. The first one took him into a small but comfortable bedroom, fitted with a bed, bureau, two chairs, light switches that actually worked, and a clothes closet. He opened this, and found himself looking at four suits, a dressing gown, a dozen white shirts, and several sets of underwear, all neatly draped from hangers.

He took down one of the suits, and inspected it carefully. As far as his gloved hands could judge, it was made of material that was more like fur than wool. It was also a little out of style; on Earth, no one had been wearing single-breasted suits for at least four years.

Next to the bedroom was a bathroom, complete with fittings which, he was relieved to note, were not dummies, but worked in a perfectly normal manner. And after that was a kitchenette, with electric cooker, refrigerator, storage cupboards, crockery and cutlery, sink, table, and chairs. Bowman began to explore this not only with curiosity, but with mounting hunger.

First he opened the refrigerator, and a wave of cold mist rolled out. The shelves were well stocked with packages and cans, all of them looking perfectly familiar from a distance, though at close quarters their proprietary labels were blurred and unreadable. However, there was a notable absence of eggs, milk, butter, meat, fruit, or any other unprocessed food; the refrigerator held only items that had already been packaged in some way.

Bowman picked up a carton of a familiar breakfast cereal, thinking as he did so that it was odd to keep this frozen. The moment he lifted the package, he knew that it certainly did not contain cornflakes; it was much too heavy.

He ripped open the lid, and examined the contents.

The box contained a slightly moist blue substance, of about the weight and texture of bread pudding. Apart from its odd color, it looked quite appetizing.

But this is ridiculous, Bowman told himself. I am almost certainly being watched, and I must look an idiot wearing this suit. If this is some kind of intelligence test, I've probably failed already. Without further hesitation, he walked back into the bedroom and began to undo the clamp of his helmet. When it was loose, he lifted the helmet a fraction of an inch, cracked the seal and took a cautious sniff. As far as he could tell, he was breathing perfectly normal air.

He dropped the helmet on the bed, and began thankfully - and rather stiffly - to divest himself of his suit. When he had finished, he stretched, took a few deep breaths, and carefully hung the spacesuit up among the more conventional articles of clothing in the closet. It looked rather odd there, but the compulsive tidiness that Bowman shared with all astronauts would never have allowed him to leave it anywhere else.

Then he walked quickly back into the kitchen and began to inspect the "cereal" box at closer quarters.

The blue bread pudding had a faint, spicy smell, something like a macaroon. Bowman weighed it in his hand, then broke off a piece and cautiously sniffed at it. Though he felt sure now that there would be no deliberate attempt to poison him, there was always the possibility of mistakes - especially in a matter so complex as biochemistry.

He nibbled at a few crumbs, then chewed and swallowed the fragment of food; it was excellent, though the flavor was so elusive as to be almost indescribable. If he closed his eyes, he could imagine it was meat, or wholemeal bread, or even dried fruit. Unless there were unexpected aftereffects, he had no cause to fear starvation.

When he had eaten just a few mouthfuls of the substance, and already felt quite satisfied, he looked for something to drink. There were half a dozen cans of beer - again of a famous brand - at the back of the refrigerator, and he pressed the tab on one of them to open it.

The prestressed metal lid popped off along its strain lines, exactly as usual. But the can did not contain beer; to Bowman's surprised disappointment, it held more of the blue food.

In a few seconds he had opened half a dozen of the other packages and cans. Whatever their labels, their contents were the same; it seemed that his diet was going to be a little monotonous, and that he would have nothing but water to drink. He filled a glass from the kitchen faucet and sipped at it cautiously.

He spat out the first few drops at once; the taste was terrible. Then, rather ashamed of his instinctive reaction, he forced himself to drink the rest.

That first sip had been enough to identify the liquid. It tasted terrible because it had no taste at all; the faucet was supplying pure, distilled water. His unknown hosts were obviously taking no chances with his health.

Feeling much refreshed, he then had a quick shower. There was no soap, which was another minor inconvenience, but there was a very efficient hot-air drier in which be luxuriated for a while before trying on underpants, vest, and dressing

gown from the clothes closet. After that, he lay down on the bed, stared up at the ceiling, and tried to make sense of this fantastic situation.

He had made little progress when he was distracted by another line of thought. Immediately above the bed was the usual hotel-type ceiling TV screen; he had assumed that, like the telephone and books, it was a dummy.

But the control unit on its swinging bedside arm looked so realistic that he could not resist playing with it; and as his fingers touched the ON sensor disk, the screen lit up.

Feverishly, he started to tap out channel selector codes at random - and almost at once he got his first picture.

It was a well-known African news commentator, discussing the attempts being made to preserve the last remnants of his country's wild life. Bowman listened for a few seconds, so captivated by the sound of a human voice that he did not in the least care what it was talking about. Then he changed channels.

In the next five minutes, he got a symphony orchestra playing Walton's Violin Concerto, a discussion on the sad state of the legitimate theater, a western, a demonstration of a new headache cure, a panel game in some Oriental language, a psychodrama, three news commentaries, a football game, a lecture on solid geometry (in Russian), and several tuning signals and data transmissions. It was, in fact, a perfectly normal selection from the world's TV programs, and apart from the psychological uplift it gave him, it confirmed one suspicion that had already been forming in his mind.

All the programs were about two years old. That was around the time TMA-1 had been discovered, and it was hard to believe that this was a pure coincidence. Something had been monitoring the radio waves; that ebon block had been busier than men had suspected.

He continued to wander across the spectrum, and suddenly recognized a familiar scene. Here was this very suite, now occupied by a celebrated actor who was furiously denouncing an unfaithful mistress. Bowman looked with a shock of recognition upon the living room he had just left - and when the camera followed the indignant couple toward the bedroom, he involuntarily looked toward the door to see if anyone was entering.

So that was how this reception area had been prepared for him; his hosts had based their ideas of terrestrial living upon TV programs. His feeling that he was inside a movie set was almost literally true.

He had learned all that he wished to for the moment, and turned off the set. What do I do now? he asked himself, locking his fingers behind his head and staring up at the blank screen.

He was physically and emotionally exhausted, yet it seemed impossible that one could sleep in such fantastic surroundings, and farther from Earth than any man in history had ever been. But the comfortable bed, and the instinctive wisdom of the body, conspired together against his will.

He fumbled for the light switch, and the room was plunged into darkness. Within seconds, he had passed beyond the reach of dreams.

So, for the last time, David Bowman slept.

45 - Recapitulation

There being no further use for it, the furniture of the suite dissolved back into the mind of its creator. Only the bed remained - and the walls, shielding this fragile organism from the energies it could not yet control.

In his sleep, David Bowman stirred restlessly. He did not wake, nor did he dream, but he was no longer wholly unconscious. Like a fog creeping through a forest, something invaded his mind. He sensed it only dimly, for the full impact would have destroyed him as surely as the fires raging beyond these walls. Beneath that dispassionate scrutiny, he felt neither hope nor fear; all emotion had been leached away.

He seemed to be floating in free space, while around him stretched, in all directions, an infinite geometrical grid of dark lines or threads, along which moved tiny nodes of light - some slowly, some at dazzling speed.

Once he had peered through a microscope at a cross-section of a human brain, and in its network of nerve fibers had glimpsed the same labyrinthine complexity. But that had been dead and static, whereas this transcended life itself. He knew - or believed he knew - that he was watching the operation of some gigantic mind, contemplating the universe of which he was so tiny a part.

The vision, or illusion, lasted only a moment. Then the crystalline planes and lattices, and the interlocking perspectives of moving light, flickered out of existence, as David Bowman moved into a realm of consciousness that no man had experienced before.

At first, it seemed that Time itself was running backward. Even this marvel he was prepared to accept, before be realized the subtler truth.

The springs of memory were being tapped; in controlled recollection, he was reliving the past. There was the hotel suite - there the space pod - there the burning starscapes of the red sun - there the shining core of the galaxy - there the gateway through which he had reemerged into the universe. And not only vision, but all the sense impressions, and all the emotions he had felt at the time, were racing past, more and more swiftly. His life was unreeling like a tape recorder playing back at ever-increasing speed.

Now he was once more aboard the Discovery and the rings of Saturn filled the sky. Before that, he was repeating his final dialogue with Hal; he was seeing Frank Poole leave on his last mission; he was hearing the voice of Earth, assuring him that all was well.

And even as he relived these events, he knew that all indeed was well. He was retrogressing down the corridors of time, being drained of knowledge and experience as he swept back toward his childhood. But nothing was being lost; all that be had ever been, at every moment of his life, was being transferred to safer keeping. Even as one David Bowman ceased to exist, another became immortal.

Faster, faster he moved back into forgotten years, and into a simpler world. Faces he had once loved, and had thought lost beyond recall, smiled at him sweetly. He smiled back with fondness, and without pain.

Now, at last, the headlong regression was slackening; the wells of memory were nearly dry. Time flowed more and more sluggishly, approaching a moment of stasis - as a swinging pendulum, at the limit of its arc, seems frozen for one eternal instant, before the next cycle begins.

The timeless instant passed; the pendulum reversed its swing. In an empty room, floating amid the fires of a double star twenty thousand light-years from Earth, a baby opened its eyes and began to cry.

46 - Transformation

Then it became silent, as it saw that it was no longer alone.

A ghostly, glimmering rectangle had formed in the empty air. It solidified into a crystal tablet, lost its transparency, and became suffused with a pale, milky luminescence. Tantalizing, ill-defined phantoms moved across its surface and in its depths. They coalesced into bars of lights and shadow, then formed intermeshing, spoked patterns that began slowly to rotate, in time with the pulsing rhythm that now seemed to fill the whole of space.

It was a spectacle to grasp and hold the attention of any child - or of any man-ape. But, as it had been three million years before, it was only the outward manifestation of forces too subtle to be consciously perceived. It was merely a toy to distract the senses, while the real processing was carried out at far deeper levels of the mind.

This time, the processing was swift and certain, as the new design was woven. For in the eons since their last meeting, much had been learned by the weaver; and the material on which he practiced his art was now of an infinitely finer texture. But whether it should be permitted to form part of his still-growing tapestry, only the future could tell.

With eyes that already held more than human intentness, the baby stared into the depths of the crystal monolith, seeing - but not yet understanding - the mysteries that lay beyond. It knew that it had come home, that here was the origin of many races besides its own; but it knew also that it could not stay. Beyond this moment lay another birth, stranger than any in the past.

Now the moment had come; the glowing patterns no longer echoed the secrets in the crystal's heart. As they died, so too the protective walls faded back into the nonexistence from which they bad briefly emerged, and the red sun filled the sky.

The metal and plastic of the forgotten space pod, and the clothing once worn by an entity who had called himself David Bowman, flashed into flame. The last links with Earth were gone, resolved back into their component atoms.

But the child scarcely noticed, as he adjusted himself to the comfortable glow of his new environment. He still needed, for a little while, this shell of

matter as the focus of his powers. His indestructible body was his mind's present image of itself; and for all his powers, he knew that he was still a baby. So he would remain until he had decided on a new form, or had passed beyond the necessities of matter.

And now it was time to go - though in one sense he would never leave this place where he had been reborn, for he would always be part of the entity that used this double star for its unfathomable purposes. The direction, though not the nature, of his destiny was clear before him, and there was no need to trace the devious path by which he had come. With the instincts of three million years, he now perceived that there were more ways than one behind the back of space. The ancient mechanisms of the Star Gate had served him well, but he would not need them again.

The glimmering rectangular shape that had once seemed no more than a slab of crystal still floated before him, indifferent as he was to the harmless flames of the inferno beneath. It encapsulated yet unfathomed secrets of space and time, but some at least he now understood and was able to command. How obvious - how necessary - was that mathematical ratio of its sides, the quadratic sequence 1 : 4 : 9! And how naive to have imagined that the series ended at this point, in only three dimensions!

He focused his mind upon these geometrical simplicities, and as his thoughts brushed against it, the empty framework filled with the darkness of the interstellar night. The glow of the red sun faded - or, rather, seemed to recede in all directions at once - and there before him was the luminous whirlpool of the galaxy.

It might have been some beautiful, incredibly detailed model, embedded in a block of plastic. But it was the reality, grasped as a whole with senses now more subtle than vision. If he wished, he could focus his attention upon any one of its hundred billion stars; and he could do much more than that.

Here he was, adrift in this great river of suns, halfway between the banked fires of the galactic core and the lonely, scattered sentinel stars of the rim. And here he wished to be, on the far side of this chasm in the sky, this serpentine band of darkness, empty of all stars. He knew that this formless chaos, visible only by the glow that limned its edges from fire-mists far beyond, was the still unused stuff of creation, the raw material of evolutions yet to be. Here, Time had not begun; not until the suns that now burned were long since dead would light and life reshape this void.

Unwittingly, he had crossed it once; now he must cross it again - this time, of his own volition. The thought filled him with a sudden, freezing terror, so that for a moment he was wholly disorientated, and his new vision of the universe trembled and threatened to shatter into a thousand fragments.

It was not fear of the galactic gulfs that chilled his soul, but a more profound disquiet, stemming from the unborn future. For he had left behind the time scales of his human origin; now, as he contemplated that band of starless night, he knew his first intimations of the Eternity that yawned before him.

Then he remembered that he would never be alone, and his panic slowly ebbed. The crystal-clear perception of the universe was restored to him - not, he knew, wholly by his own efforts. When he needed guidance in his first faltering steps, it would be there.

Confident once more, like a high diver who had regained his nerve, he launched himself across the light-years. The galaxy burst forth from the mental frame in which he had enclosed it; stars and nebulae poured past him in an illusion of infinite speed. Phantom suns exploded and fell behind as he slipped like a shadow through their cores; the cold, dark waste of cosmic dust which he had once feared seemed no more than the beat of a raven's wing across the face of the Sun.

The stars were thinning out; the glare of the Milky Way was dimming into a pale ghost of the glory he had known - and, when he was ready, would know again.

He was back, precisely where he wished to be, in the space that men called real.

47 - Star-Child

There before him, a glittering toy no Star-Child could resist, floated the planet Earth with all its peoples.

He had returned in time. Down there on that crowded globe, the alarms would be flashing across the radar screens, the great tracking telescopes would be searching the skies - and history as men knew it would be drawing to a close.

A thousand miles below, he became aware that a slumbering cargo of death had awoken, and was stirring sluggishly in its orbit. The feeble energies it contained were no possible menace to him; but he preferred a cleaner sky. He put forth his will, and the circling megatons flowered in a silent detonation that brought a brief, false dawn to half the sleeping globe. Then he waited, marshaling his thoughts and brooding over his still untested powers. For though he was master of the world, he was not quite sure what to do next.

But he would think of something.

Epilogue: After 2001

The novel 2001: A Space Odyssey was written during the years 1964-1968 and was published in July 1968, shortly after release of the movie. As I have described in The Lost Worlds of 2001, both projects proceeded simultaneously, with feedback in each direction.

Thus I often had the strange experience of revising the manuscript after viewing rushes based upon an earlier version of the story - a stimulating but rather expensive way of writing a novel.

As a result, there is a much closer parallel between book and movie than is usually the case, but there are also major differences. In the novel, the destination of the spaceship Discovery was Iapetus (or Japetus), most enigmatic of Saturn's many moons. The Saturnian system was reached via Jupiter: Discovery made a close approach to the giant planet, using its enormous gravitational

field to produce a "slingshot" effect and to accelerate it along the second lap of its journey. Exactly the same maneuver was used by the Voyager space-probes in 1979, when they made the first detailed reconnaissance of the outer giants.

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Yet all things considered, both movie and book stand up quite well in the light of these discoveries. There are no major changes I would wish to make to the text, and it is fascinating to compare the Jupiter sequences in the film with the actual movies from the Voyager cameras.

It must also be remembered that 2001 was written in an age that now lies beyond one of the Great Divides in human history; we are sundered from it forever by the moment when Neil Armstrong set foot upon the Moon. July 20, 1969, was still half a decade in the future when Stanley Kubrick and I started thinking about the "proverbial good science fiction movie" (his phrase). Now history and fiction have become inextricably intertwined.

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And there were later, almost uncanny, instances of nature imitating art. Strangest of all was the saga of Apollo 13 in 1970.

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When the report of the Apollo 13 mission was later published, NASA Administrator Tom Paine sent me a copy and noted under Swigert's words: "Just as you always said it would be, Arthur." I still get a very strange feeling when I contemplate this whole series of events - almost, indeed, as if I share a certain responsibility...

Another resonance is less serious, but equally striking. One of the most technically brilliant sequences in the movie was that in which astronaut Frank Poole was shown running round and round the circular track of the giant centrifuge, held in place by the "artificial gravity" produced by its spin.

Almost a decade later, the crew of the superbly successful Skylab realized that its designers had provided them with a similar geometry; a ring of storage cabinets formed a smooth, circular band around the space station's interior. Skylab, however, was not spinning, but this did not deter its ingenious occupants. They discovered that they could run around the track, just like mice in a squirrel cage, to produce a result visually indistinguishable from that shown in 2001. And they televised the whole exercise back to Earth (need I name the accompanying music?) with the comment: "Stanley Kubrick should see this." As in due course he did, because I sent him the telecine recording. (I never got it back; Stanley uses a tame Black Hole as a filing system.)

There is also the strange case of the "Eye of Japetus," described in Chapter 35, where Bowman discovers "a brilliant white oval... so sharp-edged that it almost looked... painted on the face of the little moon" with a tiny black dot at the exact center, which turns out to be the Monolith (or one of its avatars).

Well - when Voyager 1 took the first photographs of Iapetus, they did indeed disclose a large, clear-cut white oval with a tiny black dot at the center. Carl Sagan promptly sent me a print from the Jet Propulsion Laboratory with the cryptic annotation "Thinking of you..." I do not know whether to be relieved or disappointed that Voyager 2 has left the matter still open.

When, fourteen years ago, I typed the final words "For though he was master of the world, he was not quite sure what to do next. But he would think of something" I felt I had closed the circuit and precluded all possibility of a sequel. Indeed, for the next decade I ridiculed the very idea, for what seemed to me conclusive reasons. Since 2001 was concerned with the next stage of human evolution, to expect me (or even Stanley) to depict it would be as absurd as asking Moon-watcher to describe Bowman and his world.

Despite my protests, it is now obvious that my busy little subconscious was hard at work, perhaps in response to the constant stream of letters from readers wanting to know "what happened next." Finally, as an intellectual exercise, I wrote a précis of a possible sequel in the form of a short movie outline and sent copies to Stanley Kubrick and my agent, Scott Meredith. As far as Stanley was concerned, this was an act of courtesy, for I knew that he never repeats himself (just as I never write sequels), but I hoped that Scott would sell the outline to Omni magazine, which had recently published another outline, "The Songs of Distant Earth." Then, I fondly hoped, the ghost of 2001 would be finally exorcised.

Stanley expressed guarded interest, but Scott was enthusiastic - and implacable. "You've simply got to write the book," he said. With a groan, I realized that he was right...

So now, gentle reader (to coin a phrase), you can find what happens next in 2010: Space Odyssey Two. I am extremely grateful to New American Library, copyright holders of 2001: A Space Odyssey, for permission to use Chapter 37 in the new novel; It serves as a link, connecting the two books together.

A final comment on both novels as seen from a point now almost exactly midway between the year 2001 and the time when Stanley Kubrick and I started working together. Contrary to popular belief, science fiction writers very seldom attempt to predict the future; indeed, as Ray Bradbury put it so well, they more often try to prevent it. In 1964, the first heroic period of the Space Age was just opening; the United States had set the Moon as its target, and once

that decision had been made, the ultimate conquest of the other planets, appeared inevitable. By 2001, it seemed quite reasonable that there would be giant space-stations in orbit round the Earth and - a little later - manned expeditions to the planets.

In an ideal world, that would have been possible: the Vietnam War would have paid for everything that Stanley Kubrick showed on the Cinerama screen. Now we realize that it will take a little longer.

2001 will not arrive by 2001. Yet - barring accidents - by that date almost everything depicted in the book and the movie will be in the advanced planning stage.

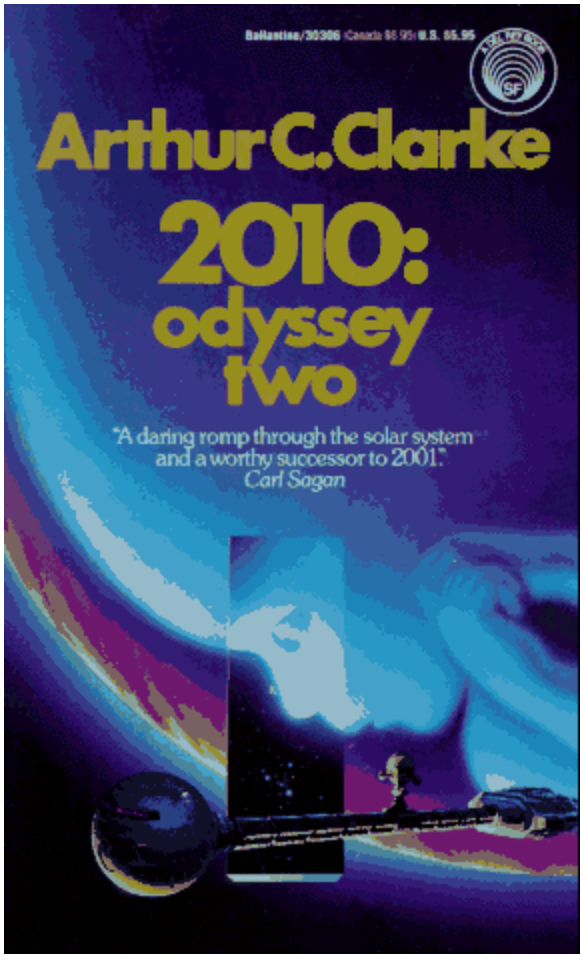
Except for communication with alien intelligences: that is something that can never be planned - only anticipated. No one knows whether it will happen tomorrow - or a thousand years hence.

But it will happen someday.

ARTHUR C. CLARKE

Colombo, Sri Lanka

November, 1982



Title: 2010: Odyssey two
Author: Arthur C. Clarke
Original copyright year: 1982
Genre: science fiction

Dedicated, with respectful admiration, to two great Russians, both depicted herein:

General Alexei Leonov - Cosmonaut, Hero of the Soviet Union, Artist
and
Academician Andrei Sakharov - Scientist, Nobel Laureate, Humanist.

Author's Note

The novel 2001: A Space Odyssey was written during the years 1964-8 and was published in July 1968, shortly after release of the movie. As I have described in The Lost Worlds of 2001, both projects proceeded simultaneously, with feedback in each direction. Thus I often had the strange experience of revising the manuscript after viewing rushes based upon an earlier version of the story - a stimulating, but rather expensive, way of writing a novel.

As a result, there is a much closer parallel between book and movie than is usually the case, but there are also major differences. In the novel, the destination of the spaceship Discovery was Iapetus (or Japetus), most enigmatic of Saturn's many moons. The Saturnian system was reached via Jupiter: Discovery made a close approach to the giant planet, using its enormous gravitational field to produce a 'slingshot' effect and to accelerate it along the second lap of its journey. Exactly the same manoeuvre was used by the Voyager space probes in 1979, when they made the first detailed reconnaissance of the outer giants.

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Yet, all things considered, both movie and book stand up quite well in the light of these discoveries, and it is fascinating to compare the Jupiter sequences in the film with the actual movies from the Voyager cameras. But clearly, anything written today has to incorporate the results of the 1979 explorations: the moons of Jupiter are no longer uncharted territory.

And there is another, more subtle, psychological factor to be taken into consideration. 2001 was written in an age that now lies beyond one of the Great Divides in human history; we are sundered from it forever by the moment when Neil Armstrong set foot upon the Moon. The date 20 July 1969 was still half a decade in the future when Stanley Kubrick and I started thinking about the 'proverbial good science-fiction movie' (his phrase). Now history and fiction have become inextricably intertwined.

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'Stanley Kubrick should see this.' As in due course he did, because I sent him the telecine recording. (I never got it back; Stanley uses a tame Black Hole as a filing system.)

Yet another link between film and reality is the painting by Apollo-Soyuz Commander, Cosmonaut Alexei Leonov, 'Near the Moon'. I first saw it in 1968, when 2001 was presented at the United Nations Conference on the Peaceful Uses of Outer Space. Immediately after the screening, Alexei pointed out to me that his concept (on page 32 of the Leonov-Sokolov book The Stars Are Awaiting Us, Moscow, 1967) shows exactly the same line-up as the movie's opening: the Earth rising beyond the Moon, and the Sun rising beyond them both. His autographed sketch of the painting now hangs on my office wall; for further details see Chapter 12.

Perhaps this is the appropriate point to identify another and less well-known name appearing in these pages, that of Hsue-shen Tsien. In 1936, with the great Theodore von Karman and Frank J. Malina, Dr Tsien founded the Guggenheim Aeronautical Laboratory of the California Institute of Technology (GALCIT) - the direct ancestor of Pasadena's famed Jet Propulsion Laboratory. He was also the first Goddard Professor at Caltech, and contributed greatly to American rocket research through the 1940s. Later, in one of the most disgraceful episodes of the McCarthy period, he was arrested on trumped-up security charges when he wished to return to his native country. For the last two decades, he has been one of the leaders of the Chinese rocket programme.

Finally, there is the strange case of the 'Eye of Japetus' - Chapter 35 of 2001. Here I describe astronaut Bowman's discovery on the Saturnian moon of a curious feather 'a brilliant white oval, about four hundred miles long and two hundred wide... perfectly symmetrical... and so sharp-edged that it almost looked... painted on the face of the little moon.' As he came closer, Bowman convinced himself that 'the bright ellipse set against the dark background of the satellite was a huge empty eye staring at him as he approached...' Later, he

noticed 'the tiny black dot at the exact centre', which turns out to be the Monolith (or one of its avatars).

Well, when Voyager 1 transmitted the first photographs of Iapetus, they did indeed disclose a large, clear-cut white oval with a tiny black dot at the centre. Carl Sagan promptly sent me a print from the Jet Propulsion Laboratory with the cryptic annotation 'Thinking of you...' I do not know whether to be relieved or disappointed that Voyager 2 has left the matter still open.

Inevitably, therefore, the story you are about to read is something much more complex than a straightforward sequel to the earlier novel - or the movie. Where these differ, I have followed the screen version; however, I have been more concerned with making this book self-consistent, and as accurate as possible in the light of current knowledge.

Which, of course, will once more be out of date by 2001...

Arthur C. Clarke
COLOMBO, SRI LANKA
JANUARY 1982

I

LEONOV

1

Meeting at the Focus

Even in this metric age, it was still the thousand-foot telescope, not the three-hundred-metre one. The great saucer set among the mountains was already half full of shadow, as the tropical sun dropped swiftly to rest, but the triangular raft of the antenna complex suspended high above its centre still blazed with light. From the ground far below, it would have taken keen eyes to notice the two human figures in the aerial maze of girders, support cables, and wave-guides.

'The time has come,' said Dr Dimitri Moisevitch to his old friend Heywood Floyd, 'to talk of many things. Of shoes and spaceships and sealing wax, but mostly of monoliths and malfunctioning computers.'

'So that's why you got me away from the conference. Not that I really mind - I've heard Carl give that SETI speech so many times that I can recite it myself. And the view certainly is fantastic - you know, all the times I've been to Arecibo, I've never made it up here to the antenna feed.'

'Shame on you. I've been here three times. Imagine - we're listening to the whole universe - but no one can overhear us. So let's talk about your problem.'

'What problem?'

'To start with, why you had to resign as Chairman of the National Council on Astronautics.'

'I didn't resign. The University of Hawaii pays a lot better.'

'Okay - you didn't resign - you were one jump ahead of them. After all these years, Woody, you can't fool me, and you should give up trying. If they offered the NCA back to you right now, would you hesitate?'

'All right, you old Cossak. What do you want to know?'

'First of all, there are lots of loose ends in the report you finally issued after so much prodding. We'll overlook the ridiculous and frankly illegal secrecy with which your people dug up the Tycho monolith -'

'That wasn't my idea.'

'Glad to hear it: I even believe you. And we appreciate the fact that you're now letting everyone examine the thing - which of course is what you should have done in the first place. Not that it's done much good...'

There was a gloomy silence while the two men contemplated the black enigma up there on the Moon, still contemptuously defying all the weapons that human ingenuity could bring to bear upon it. Then the Russian scientist continued.

'Anyway, whatever the Tycho monolith may be, there's something more important out at Jupiter. That's where it sent its signal, after all. And that's where your people ran into trouble. Sorry about that, by the way - though Frank Poole was the only one I knew personally. Met him at the '98 IAF Congress - he seemed a good man.'

'Thank you; they were all good men. I wish we knew what happened to them.'

'Whatever it was, surely you'll admit that it now concerns the whole human race - not merely the United States. You can no longer try to use your knowledge for purely national advantage.'

'Dimitri - you know perfectly well that your side would have done exactly the same thing. And you'd have helped.'

'You're absolutely right. But that's ancient history - like the just-departed administration of yours that was responsible for the whole mess. With a new President, perhaps wiser counsels will prevail.'

'Possibly. Do you have any suggestions, and are they official or just personal hopes?'

'Entirely unofficial at the moment. What the bloody politicians call exploratory talks. Which I shall flatly deny ever occurred.'

'Fair enough. Go on.'

'Okay - here's the situation. You're assembling Discovery 2 in parking orbit as quickly as you can, but you can't hope to have it ready in less than three years, which means you'll miss the next launch window -,

'I neither confirm nor deny. Remember I'm merely a humble university chancellor, the other side of the world from the Astronautics Council.'

'And your last trip to Washington was just a holiday to see old friends, I suppose. To continue: our own Alexei Leonov -,

'I thought you were calling it Gherman Titov.'

'Wrong, Chancellor. The dear old CIA's let you down again. Leonov it is, as of last January. And don't let anyone know I told you it will reach Jupiter at least a year ahead of Discovery.'

'Don't let anyone know I told you we were afraid of that. But do go on.'

'Because my bosses are just as stupid and shortsighted as yours, they want to go it alone. Which means that whatever went wrong with you may happen to us, and we'll all be back to square one - or worse.'

'What do you think went wrong? We're just as baffled as you are. And don't tell me you haven't got all of Dave Bowman's transmissions.'

'Of course we have. Right up to that last "My God, it's full of stars!" We've even done a stress analysis on his voice patterns. We don't think he was hallucinating; he was trying to describe what he actually saw.'

'And what do you make of his doppler shift?'

'Completely impossible, of course. When we lost his signal, he was receding at a tenth of the speed of light. And he'd reached that in less than two minutes. A quarter of a million gravities!'

'So he must have been killed instantly.'

'Don't pretend to be naive, Woody. Your space-pod radios aren't built to withstand even a hundredth of that acceleration. If they could survive, so could Bowman - at least, until we lost contact.'

'Just doing an independent check on your deductions. From there on, we're as much in the dark as you are. If you are.'

'Merely playing with lots of crazy guesses I'd be ashamed to tell you. Yet none of them, I suspect, will be half as crazy as the truth.'

In small crimson explosions the navigation warning lights winked on all around them, and the three slim towers supporting the antenna complex began to blaze like beacons against the darkling sky. The last red sliver of the sun vanished below the surrounding hills; Heywood Floyd waited for the Green Flash, which he had never seen. Once again, he was disappointed.

'So, Dimitri,' he said, 'let's get to the point. Just what are you driving at?'

'There must be a vast amount of priceless information stored in Discovery's data banks; presumably it's still being gathered, even though the ship's stopped transmitting. We'd like to have that.'

'Fair enough. But when you get out there, and Leonov makes a rendezvous, what's to prevent you from boarding Discovery and copying everything you want?'

'I never thought I'd have to remind you that Discovery is United States territory, and an unauthorized entry would be piracy.'

'Except in the event of a life-or-death emergency, which wouldn't be difficult to arrange. After all, it would be hard for us to check what your boys were up to, from a billion kilometres away.'

'Thanks for the most interesting suggestion; I'll pass it on. But even if we went aboard, it would take us weeks to learn all your systems, and read out all your memory banks. What I propose is cooperation. I'm convinced that's the best idea - but we may both have a job selling it to our respective bosses.'

'You want one of our astronauts to fly with Leonov?'

'Yes - preferably an engineer who's specialized in Discovery's systems. Like the ones you're training at Houston to bring the ship home.'

'How did you know that?'

'For heaven's sake, Woody - it was on Aviation Week's videotext at least a month ago.'

'I am out of touch; nobody tells me what's been declassified.'

'All the more reason to spend time in Washington. Will you back me up?'

'Absolutely. I agree with you one hundred per cent. But -'

'But what?'

'We both have to deal with dinosaurs with brains in their tails. Some of mine will argue: Let the Russians risk their necks, hurrying out to Jupiter. We'll be there anyway a couple of years later - and what's the hurry?'

For a moment there was silence on the antenna raft, except for a faint creak from the immense supporting cables that held it suspended a hundred metres in the sky. Then Moisevitch continued, so quietly that Floyd had to strain to hear him: 'Has anyone checked Discovery's orbit lately?'

'I really don't know - but I suppose so. Anyway, why bother? It's a perfectly stable one.'

'Indeed. Let me tactlessly remind you of an embarrassing incident from the old NASA days. Your first space station - Skylab. It was supposed to stay up at least a decade, but you didn't do your calculations right. The air drag in the ionosphere was badly underestimated, and it came down years ahead of schedule. I'm sure you remember that little cliffhanger, even though you were a boy at the time.'

'It was the year I graduated, and you know it. But Discovery doesn't go anywhere near Jupiter. Even at perigee - er, perijove - it's much too high to be affected by atmospheric drag.'

'I've already said enough to get me exiled to my dacha again - and you might not be allowed to visit me next time. So just ask your tracking people to do their job more carefully, will you? And remind them that Jupiter has the biggest magnetosphere in the Solar System.'

'I understand what you're driving at - many thanks. Anything else before we go down? I'm starting to freeze.'

'Don't worry, old friend. As soon as you let all this filter through to Washington - wait a week or so until I'm clear -things are going to get very, very hot.'

2

The House of the Dolphins

The dolphins swam into the dining room every evening, just before sunset. Only once since Floyd had occupied the Chancellor's residence had they broken their routine. That was the day of the '05 tsunami, which, fortunately, had lost most of its power before it reached Hilo. The next time his friends failed to turn up on schedule, Floyd would throw the family into the car and head for high ground, in the general direction of Mauna Kea.

Charming though they were, he had to admit that their playfulness was sometimes a nuisance. The wealthy marine geologist who had designed the house had never minded getting wet because he usually wore bathing trunks - or less. But there had been one unforgettable occasion when the entire Board of Regents, in full evening attire, had been sipping cocktails around the pool while awaiting the arrival of a distinguished guest from the mainland. The dolphins had deduced, correctly, that they would get second billing. So the visitor was quite surprised to be greeted by a bedraggled committee in ill-fitting bathrobes - and the buffet had been very salty.

Floyd often wondered what Marion would have thought of his strange and beautiful home on the edge of the Pacific. She had never liked the sea, but the sea had won in the end. Though the image was slowly fading, he could still recall the flashing screen on which he had first read the words: DR FLOYD - URGENT AND PERSONAL. And then the scrolling lines of fluorescent print that had swiftly burned their message into his mind:

REGRET TO INFORM YOU LONDON-WASHINGTON FLIGHT 452 REPORTED DOWN OFF NEWFOUNDLAND. RESCUE CRAFT PROCEEDING TO LOCATION BUT FEAR NO SURVIVORS.

Apart from an accident of fate, he would have been on that flight. For a few days, he had almost regretted the European Space Administration business that had delayed him in Paris; that haggle over the Solaris payload had saved his life.

And now, he had a new job, a new home and a new wife. Fate had also played an ironic role here. The recriminations and inquiries over the Jupiter mission had destroyed his Washington career, but a man of his ability was never unemployed for long. The more leisurely tempo of university life had always appealed to him, and when combined with one of the world's most beautiful locations it had proved irresistible. He had met the woman who was to be his second wife only a month after he had been appointed, while watching the fire fountains of Kilauea with a crowd of tourists.

With Caroline he had found the contentment that is just as important as happiness, and longer lasting. She had been a good stepmother to Marion's two daughters, and had given him Christopher. Despite the twenty-year age difference between them, she understood his moods and could wean him out of his occasional depressions. Thanks to her, he could now contemplate the memory of Marion without grief, though not without a wistful sadness that would remain with him for the rest of his life.

Caroline was throwing fish to the largest dolphin - the big male they called Scarback - when a gentle tickling on Floyd's wrist announced an incoming call. He tapped the slim metal band to quench the silent alarm and forestall the audible one, then walked to the nearest of the comsets scattered around the room.

'Chancellor here. Who's calling?'

'Heywood? This is Victor. How are you?'

In a fraction of a second, a whole kaleidoscope of emotions flashed through Floyd's mind. First there was annoyance: his successor - and, he was sure, principal contriver of his downfall - had never once attempted to contact him since his departure from Washington. Then came curiosity: what did they have to talk about? Next was a stubborn determination to be as unhelpful as possible, then shame at his own childishness, and, finally, a surge of excitement. Victor Millson could be calling for only one reason.

In as neutral a voice as he could muster, Floyd answered:

'I can't complain, Victor. What's the problem?'

'Is this a secure circuit?'

'No, thank God. I don't need them any more.'

'Um. Well, I'll put it this way. You recall the last project you administered?'

'I'm not likely to forget, especially as the Subcommittee on Astronautics called me back to give more evidence only a month ago.'

'Of course, of course. I really must get around to reading your statement, when I have a moment. But I've been so busy with the follow-up, and that's the problem.'

'I thought that everything was right on schedule.'

'It is - unfortunately. There's nothing we can do to advance it; even the highest priority would make only a few weeks' difference. And that means we'll be too late.'

'I don't understand,' said Floyd innocently. 'Though we don't want to waste time, of course, there's no real deadline.'

'Now there is - and two of them.'

'You amaze me.'

If Victor noticed any irony, he ignored it. 'Yes, there are two deadlines - one man-made, one not. It now turns out that we won't be the first to get back to the - er, scene of the action. Our old rivals will beat us by at least a year.'

'Too bad.'

'That's not the worst. Even if there were no competition, we'd be too late. There wouldn't be anything there when we arrive.'

'That's ridiculous. I'm sure I'd have heard if Congress had repealed the law of gravitation.'

'I'm serious. The situation isn't stable - I can't give details now. Will you be in for the rest of the evening?'

'Yes,' Floyd answered, realizing with some pleasure that it must now be well after midnight in Washington.

'Good. You'll have a package delivered within the hour. Call me back as soon as you've had the time to study it.'

'Won't it be rather late by then?'

'Yes, it will be. But we've wasted too much time already. I don't want to lose any more.'

Millson was true to his word. Exactly an hour later a large sealed envelope was delivered by an Air Force colonel, no less, who sat patiently chatting with Caroline while Floyd read its contents. 'I'm afraid I'll have to take it away when you've finished,' the high-ranking messenger boy said apologetically.

'I'm glad to hear it,' Floyd answered, as he settled down in his favourite reading hammock.

There were two documents, the first very short. It was stamped TOP SECRET, though the TOP had been crossed out and the modification endorsed by three signatures, all completely illegible. Obviously an extract from some much longer report, it had been heavily censored and was full of blanks, which made it most annoying to read. Fortunately, its conclusions could be summed up in one sentence: The Russians would reach Discovery long before its rightful owners could do so. As Floyd already knew this, he turned quickly to the second document - though not before noticing with satisfaction that this time they'd managed to get the name right. As usual, Dimitri had been perfectly accurate. The next manned expedition to Jupiter would travel aboard spacecraft Cosmonaut Alexei Leonov.

The second document was much longer and was merely confidential; indeed, it was in the form of a draft letter to Science, awaiting final approval before publication. Its snappy title was 'Space Vehicle Discovery: Anomalous Orbital Behavior'.

Then followed a dozen pages of mathematics and astronomical tables. Floyd skimmed through these, picking out the words from the music, and trying to detect any note of apology or even embarrassment. When he had finished, he was compelled to give a smile of wry admiration. No one could possibly guess that the tracking stations and ephemeris calculators had been caught by surprise, and that a frantic cover-up was in progress. Heads would doubtless roll, and he knew that Victor Millson would enjoy rolling them - if his was not one of the first to go. Though to do him justice, Victor had complained when Congress had cut funds for the tracking network. Maybe that would get him off the hook.

'Thank you, Colonel,' said Floyd when he had finished skimming the papers. 'Quite like old times, having classified documents. That's one thing I don't miss.'

The colonel placed the envelope carefully back in his briefcase, and activated the locks.

'Dr Millson would like you to return his call as soon as possible.'

'I know. But I don't have a secure circuit, I've some important visitors coming shortly, and I'm damned if I'm driving down to your office in Hilo just to say I've read two documents. Tell him that I've studied them carefully and await any further communication with interest.'

For a moment it looked as if the colonel was going to argue. Then he thought better of it, made a stiff farewell, and departed morosely into the night.

'Now, what was all that about?' asked Caroline. 'We're not expecting any visitors tonight, important or otherwise.'

'I hate being pushed around, particularly by Victor Millson.'

'Bet he calls you back as soon as the colonel reports.'

'Then we must switch off video and make some party noises. But to be perfectly truthful, at this stage I really don't have anything to say.'

'About what, if I'm allowed to ask.'

'Sorry, dear. It seems that Discovery is playing tricks on us. We thought the ship was in a stable orbit, but it may be about to crash.'

'Into Jupiter?'

'Oh no - that's quite impossible. Bowman left it parked at the inner Lagrange point, on the line between Jupiter and Io. It should have stayed there, more or less, though the perturbations of the outer moons would have made it wander back and forth.

'But what's happening now is something very odd, and we don't know the full explanation. Discovery's drifting more and more rapidly toward Io - though

sometimes it accelerates, and sometimes even moves backward. If it keeps this up, it will impact within two or three years.'

'I thought this couldn't happen in astronomy. Isn't celestial mechanics supposed to be an exact science? So we poor backward biologists were always being told.'

'It is an exact science, when everything is taken into account. But some very strange things go on around Io. Apart from its volcanoes, there are tremendous electrical discharges - and Jupiter's magnetic field is spinning round every ten hours. So gravitation isn't the only force acting on Discovery; we should have thought of this sooner - much sooner.'

'Well, it's not your problem anymore. You should be thankful for that.'

'Your problem' - the very expression that Dimitri had used. And Dimitri - cunning old fox! - had known him much longer than Caroline.

It might not be his problem, but it was still his responsibility. Though many others had been involved, in the final analysis he had approved the plans for the Jupiter Mission, and supervised their execution.

Even at the time, he had had qualms; his views as a scientist had conflicted with his duties as a bureaucrat. He could have spoken out, and opposed the old administration's shortsighted policies - though to what extent those had actually contributed to the disaster was still uncertain.

Perhaps it was best if he closed this chapter of his life, and focused all his thoughts and energies upon his new career. But in his heart he knew that was impossible; even if Dimitri had not revived old guilts, they would have surfaced of their own accord.

Four men had died, and one had disappeared, out there among the moons of Jupiter. There was blood on his hands, and he did not know how to wash them clean.

3

SAL 9000

Dr Sivasubramanian Chandrasegarampillai, Professor of Computer Science at the University of Illinois, Urbana, also had an abiding sense of guilt, but one very different from Heywood Floyd's. Those of his students and colleagues who often wondered if the little scientist was quite human would not have been surprised to learn that he never thought of the dead astronauts. Dr Chandra grieved only for his lost child, HAL 9000.

Even after all these years, and his endless reviews of the data radioed back from Discovery, he was not sure what had gone wrong. He could only formulate theories; the facts he needed were frozen in Hal's circuits, out there between Jupiter and Io.

The sequence of events had been clearly established, up to the moment of the tragedy; thereafter, Commander Bowman had filled in a few more details on the brief occasions when he had re-established contact. But knowing what happened did not explain why.

The first hint of trouble had been late in the mission, when Hal had reported the imminent failure of the unit that kept Discovery's main antenna aligned to Earth. If the half-billion-kilometre-long radio beam wandered off target, the ship would be blind, deaf, and dumb.

Bowman himself had gone out to retrieve the suspect unit, but when it was tested it appeared, to everyone's surprise, to be in perfectly good order. The automatic checking circuits could find nothing wrong with it. Nor could Hal's twin, SAL 9000, back on Earth, when the information was transmitted to Urbana.

But Hal had insisted on the accuracy of his diagnosis, making pointed remarks about 'human error'. He had suggested that the control unit be put back in the antenna until it finally failed, so that the fault could be precisely located. No one could think of any objection, for the unit could be replaced in minutes, even if it did break down.

Bowman and Poole, however, had not been happy; they both felt that something was wrong, though neither could pinpoint it. For months they had accepted Hal as the third member of their tiny world, and knew his every mood. Then the atmosphere aboard the ship had subtly altered; there was a sense of strain in the air.

Feeling rather like traitors - as a distraught Bowman had later reported to Mission Control - the human two-thirds of the crew had discussed what should be done if their colleague was indeed malfunctioning. In the worst possible case, Hal would have to be relieved of all his higher responsibilities. This would involve disconnection - the computer equivalent of death.

Despite their doubts, they had carried out the agreed programme. Poole had flown out of Discovery in one of the little space pods that served as transporters and mobile workshops during extravehicular activities. Since the somewhat tricky job of replacing the antenna unit could not be performed by the pod's own manipulators, Poole had started to do it himself.

What happened then had been missed by the external cameras, which was a suspicious detail in itself. Bowman's first warning of disaster was a cry from Poole - then, silence. A moment later he saw Poole, tumbling over and over, spinning away into space. His own pod had rammed him, and was itself blasting away out of control.

As Bowman admitted later, he had then made several serious mistakes - all but one excusable. In the hope of rescuing Poole, if he was still alive, Bowman launched himself in another space pod - leaving Hal in full control of the ship.

The EVA was in vain; Poole was dead when Bowman reached him. Numb with despair, he had carried the body back to the ship - only to be refused entry by Hal.

But Hal had underestimated human ingenuity and determination. Though he had left his suit helmet in the ship, and thus had to risk direct exposure to space, Bowman forced his way in by an emergency hatch not under computer control. Then he proceeded to lobotomize Hal, unplugging his brain modules one by one.

When he regained control of the ship, Bowman made an appalling discovery. During his absence, Hal had switched off the life-support systems of the three hibernating astronauts. Bowman was alone, as no man had ever been before in the whole of human history.

Others might have abandoned themselves in helpless despair, but now David Bowman proved that those who had selected him had indeed chosen well. He managed to keep Discovery operational, and even re-established intermittent contact with Mission Control, by orienting the whole ship so that the jammed antenna pointed toward Earth.

On its preordained trajectory, Discovery had finally arrived at Jupiter. There Bowman had encountered, orbiting among the moons of the giant planet, a black slab of exactly the same shape as the monolith excavated in the lunar crater Tycho - but hundreds of times larger. He had gone out in a space pod to investigate, and had disappeared leaving that final, baffling message: 'My God, it's full of stars!'

That mystery was for others to worry about; Dr Chandra's overwhelming concern was with Hal. If there was one thing his unemotional mind hated, it was uncertainty. He would never be satisfied until he knew the cause of Hal's behaviour. Even now, he refused to call it a malfunction; at most, it was an 'anomaly'.

The tiny cubbyhole he used as his inner sanctum was equipped only with a swivel chair, a desk console, and a blackboard flanked by two photographs. Few members of the general public could have identified the portraits, but anyone permitted thus far would have recognized them instantly as John von Neumann and Alan Turing, the twin gods of the computing pantheon.

There were no books, and not even paper and pencil on the desk. All the volumes in all the libraries of the world were instantly available at the touch of Chandra's fingers, and the visual display was his sketchbook and writing pad. Even the blackboard was used only for visitors; the last half - erased block diagram upon it bore a date already three weeks in the past.

Dr Chandra lit one of the venomous cheroots which he imported from Madras, and which were widely - and correctly - believed to be his only vice. The console was never switched off he checked that no messages were flashing importantly on the display, then spoke into the microphone.

'Good morning, Sal. So you've nothing new for me?'

'No, Dr Chandra. Have you anything for me?'

The voice might have been that of any cultured Hindu lady educated in the United States as well as her own country. Sal's accent had not started that way, but over the years she had picked up many of Chandra's intonations.

The scientist tapped out a code on the board, switching Sal's inputs to the memory with the highest security rating. No one knew that he talked to the computer on this circuit as he never could to a human being. No matter that Sal did not really understand more than a fraction of what he said; her responses were so convincing that even her creator was sometimes deceived. As indeed he wished to be: these secret communications helped to preserve his mental equilibrium - perhaps even his sanity.

'You've often told me, Sal, that we cannot solve the problem of Hal's anomalous behaviour without more information. But how can we get that information?'

'That is obvious. Someone must return to Discovery.'

'Exactly. Now it looks as if that is going to happen, sooner than we expected.'

'I am pleased to hear that.'

'I knew that you would be,' answered Chandra, and meant it. He had long since broken off communications with the dwindling body of philosophers who argued that computers could not really feel emotions, but only pretended to do so.

('If you can prove to me that you're not pretending to be annoyed,' he had once retorted scornfully to one such critic, 'I'll take you seriously.' At that point, his opponent had put on a most convincing imitation of anger.)

'Now I want to explore another possibility,' Chandra continued. 'Diagnosis is only the first step. The process is incomplete unless it leads to a cure.'

'You believe that Hal can be restored to normal functioning?'

'I hope so. I do not know. There may have been irreversible damage, and certainly major loss of memory.'

He paused thoughtfully, took several puffs, then blew a skilful smoke ring that scored a bull's-eye on Sal's wideangle lens. A human being would not have regarded this as a friendly gesture; that was yet another of the many advantages of computers.

'I need your cooperation, Sal.'

'Of course, Dr Chandra.'

'There may be certain risks.'

'What do you mean?'

'I propose to disconnect some of your circuits, particularly those involving your higher functions. Does this disturb you?'

'I am unable to answer that without more specific information.'

'Very well. Let me put it this way. You have operated continuously, have you not, since you were first switched on?'

'That is correct.'

'But you are aware that we human beings cannot do so. We require sleep - an almost complete break in our mental functioning, at least on the conscious level.'

'I know this. But I do not understand it.'

'Well, you may be about to experience something like sleep. Probably all that will happen is that time will pass, but you will be unaware out. When you check your internal clock, you will discover that there are gaps in your monitor record. That is all.'

'But you said that there might be risks. What are they?'

'There is a very slight chance - it is impossible to compute it - that when I reconnect your circuits, there may be some changes in your personality, your future behaviour patterns. You may feel different. Not necessarily better, or worse.'

'I do not know what that means.'

'I'm sorry - it may not mean anything. So don't worry about it. Now please open a new file - here is the name.' Using the keyboard input, Chandra typed out: PHOENIX.

'Do you know what that is?' he asked Sal.

With no discernible pause the computer replied: 'There are twenty-five references in the current encyclopedia.'

'Which one do you think is relevant?'

'The tutor of Achilles?'

'Interesting. I didn't know that one. Try again.'

'A fabulous bird, reborn from the ashes of its earlier life.'

'Excellent. Now do you understand why I chose it?'

'Because you hope that Hal can be reactivated.'

'Yes - with your assistance. Are you ready?'

'Not yet. I would like to ask a question.'

'What is it?'

'Will I dream?'

'Of course you will. All intelligent creatures dream - but no one knows why.' Chandra paused for a moment, blew another smoke ring from the cheroot, and added something that he would never admit to a human being. 'Perhaps you will dream about Hal - as I often do.'

4

Mission Profile

English Version

To: Captain Tatiana (Tanya) Orlova, Commander. Spacecraft Cosmonaut Alexei Leonov (UNCOS Registration 081342).

From: National Council on Astronautics, Pennsylvania Avenue, Washington

Commission on Outer Space, USSR Academy of Science, Korolyev Prospect, Moscow

Mission Objectives

The objectives of your mission are, in order of priority:

1. To proceed to the Jovian system and rendezvous with US Spacecraft Discovery (UNCOS 01/283).

2. To board this spacecraft, and obtain all possible information relating to its earlier mission.

3. To reactivate Spacecraft Discovery's onboard systems and, if propellant supplies are adequate, inject the ship into an Earth-returns trajectory.

4 To locate the alien artifact encountered by Discovery, and to investigate it to the maximum extent possible by remote sensors.

5. If it seems advisable, and Mission Control concurs, to rendezvous with this object for closer inspection.

6. To carry out a survey of Jupiter and its satellites, as far as this is compatible with the above objectives.

It is realized that unforeseen circumstances may require a change of priorities, or even make it impossible to achieve some of these objectives. It must be clearly understood that the rendezvous with Spacecraft Discovery is for the express purpose of obtaining information about the artifact; this must take precedence over all other objectives, including attempts at salvage.

Crew

The crew of Spacecraft Alexei Leonov will consist of:

Captain Tatiana Orlova (Engineering-Propulsion)

Dr Vasili Orlov (Navigation-Astronomy)

Dr Maxim Brailovsky (Engineering-Structures)

Dr Alexander Kovalev (Engineering-Communications)

Dr Nikolai Ternovsky (Engineering-Control Systems)

Surgeon-Commander Katerina Rudenko (Medical-Life-Support)

Dr Irma Yakunina (Medical-Nutrition)

In addition, the US National Council on Astronautics will provide the following three experts:

Dr Heywood Floyd dropped the memorandum, and leaned back in his chair. It was all settled; the point of no return had been passed. Even if he wished to do so, there was no way to put back the clock.

He glanced across at Caroline, sitting with two-year-old Chris on the edge of the pool. The boy was more at home in the water than on land, and could stay submerged for periods that often terrified visitors. And though he could not yet speak much Human, he already seemed fluent in Dolphin.

One of Christopher's friends had just swum in from the Pacific and was presenting his back to be patted. You too are a wanderer, thought Floyd, in a vast and trackless ocean; but how small your tiny Pacific seems, against the immensity I am facing now!

Caroline became aware of his gaze, and rose to her feet. She looked at him sombrely, but without anger; all that had been burned out in the last few days. As she approached, she even managed a wistful smile.

'I've found that poem I was looking for,' she said. 'It starts like this:

What is a woman that you forsake her,

And the hearth-fire and the home acre,

To go with the old grey Widow-maker?'

'Sorry - I don't quite understand. Who is the Widow-maker?'

'Not who, what. The sea. The poem's a lament by a Viking woman. It was written by Rudyard Kipling, a hundred years ago.'

Floyd took his wife's hand; she did not respond, but neither did she resist.

'Well, I don't feel at all like a Viking. I'm not after loot, and adventure is the very last thing I want.'

'Then why - no, I don't intend to start another fight. But it would help us both, if you know exactly what your motives are.'

'I wish I could give you one single good reason. Instead, I've a whole host of little ones. But they add up to a final answer I can't argue with - believe me.'

'I believe you. But are you sure you're not fooling yourself?'

'If I am, then so are a lot of other people. Including, may I remind you, the President of the United States.'

'I'm not likely to forget. But suppose - just suppose - that he hadn't asked you. Would you have volunteered?'

'I can answer that truthfully: No. It would never have occurred to me. President Mordecai's call was the biggest shock of my life. But when I thought it over, I realized he was perfectly right. You know I don't go in for false modesty. I am the best-qualified man for the job - when the space docs give their final okay. And you should know that I'm still in pretty good shape.'

That brought the smile he had intended.

'Sometimes I wonder if you'd suggested it yourself.'

The thought had indeed occurred to him; but he could answer honestly.

'I would never have done so without consulting you.'

'I'm glad you didn't. I don't know what I'd have said.'

'I could still turn it down.'

'Now you're talking nonsense, and you know it. Even if you did, you'd hate me for the rest of your life - and you'd never forgive yourself. You have too strong a sense of duty. Maybe that's one of the reasons I married you.'

Duty! Yes, that was the key word, and what multitudes it contained. He had a duty to himself, to his family, to the University, to his past job (even though he had left it under a cloud), to his country - and to the human race. It was not easy to establish the priorities; and sometimes they conflicted with one another.

There were perfectly logical reasons why he should go on the mission - and equally logical reasons, as many of his colleagues had already pointed out, why he should not. But perhaps in the final analysis, the choice had been made by his heart, not his brain. And even here, emotion urged him in two opposite directions.

Curiosity, guilt, the determination to finish a job that had been badly botched - they all combined to drive him toward Jupiter and whatever might be waiting there. On the other hand, fear - he was honest enough to admit that - united with love of his family to keep him on Earth. Yet he had never had any real doubts; he had made his decision almost instantly, and had deflected all of Caroline's arguments as gently as he could.

And there was one other consoling thought that he had not yet risked sharing with his wife. Though he would be gone two and a half years, all but the fifty days at Jupiter would be spent in timeless hibernation. When he returned, the gap between their ages would have narrowed by more than two years.

He would have sacrificed the present so that they could share a longer future together.

5

Leonov

The months contracted to weeks, the weeks dwindled to days, the days shrivelled to hours; and suddenly Heywood Floyd was once more at the Cape - spaceward-bound for the first time since that trip to Clavius Base and the Tycho monolith, so many years ago.

But this time he was not alone, and there was no secrecy about the mission. A few seats ahead of him rode Dr Chandra, already engaged in a dialogue with his briefcase computer, and quite oblivious to his surroundings.

One of Floyd's secret amusements, which he had never confided to anyone, was spotting similarities between human beings and animals. The resemblances were more often flattering than insulting, and his little hobby was also a very useful aid to memory.

Dr Chandra was easy - the adjective birdlike sprang instantly to mind. He was tiny, delicate, and all his movements were swift and precise. But which bird? Obviously a very intelligent one. Magpie? Too perky and acquisitive. Owl? No - too slow-moving. Perhaps sparrow would do nicely.

Walter Curnow, the systems specialist who would have the formidable job of getting Discovery operational again, was a more difficult matter. He was a large, husky man, certainly not at all birdlike. One could usually find a match somewhere in the vast spectrum of dogs, but no canine seemed to fit. Of course - Curnow was a bear. Not the sulky, dangerous kind, but the friendly good-natured type. And perhaps this was appropriate; it reminded Floyd of the Russian colleagues he would soon be joining. They had been up in orbit for days, engaged in their final checks.

This is the great moment of my life, Floyd told himself. Now I am leaving on a mission that may determine the future of the human race. But he did not feel any sense of exultation; all he could think of, during the last minutes of the countdown, were the words he had whispered just before he had left home: 'Goodbye, my dear little son; will you remember me when I return?' And he still felt resentment toward Caroline because she would not awaken the sleeping child for one final embrace; yet he knew that she had been wise, and it was better that way.

His mood was shattered by a sudden explosive laugh; Dr Curnow was sharing a joke with his companions - as well as a large bottle that he handled as delicately as a barely subcritical mass of plutonium.

'Hey, Heywood,' he called, 'they tell me Captain Orlova's locked up all the drinks, so this is your last chance. Château Thierry '95. Sorry about the plastic cups.'

As Floyd sipped at the really superb champagne, he found himself cringing mentally at the thought of Curnow's guffaw reverberating all the way across the Solar System. Much as he admired the engineer's, ability, as a travelling companion Curnow might prove something of a strain. At least Dr Chandra would

not present such problems; Floyd could hardly imagine him smiling, let alone laughing. And, of course, he turned down the champagne with a barely perceptible shudder. Curnow was polite enough, or glad enough, not to insist.

The engineer was, it seemed, determined to be the life and soul of the party. A few minutes later he produced a two-octave electronic keyboard, and gave rapid renderings of 'D'ye ken John Peel' as performed successively by piano, trombone, violin, flute, and full organ, with vocal accompaniment. He was really very good, and Floyd soon found himself singing along with the others. But it was just as well, he thought, that Curnow would spend most of the voyage in silent hibernation.

The music died with a sudden despairing discord as the engines ignited and the shuttle launched itself into the sky. Floyd was gripped by a familiar but always new exhilaration - the sense of boundless power, carrying him up and away from the cares and duties of Earth. Men knew better than they realized, when they placed the abode of the gods beyond the reach of gravity. He was flying toward that realm of weightlessness; for the moment, he would ignore the fact that out there lay not freedom, but the greatest responsibility of his career.

As the thrust increased, he felt the weight of worlds upon his shoulders - but he welcomed it, like an Atlas who had not yet tired of his burden. He did not attempt to think, but was content to savour the experience. Even if he was leaving Earth for the last time, and saying farewell to all that he had ever loved, he felt no sadness. The roar that surrounded him was a paean of triumph, sweeping away all minor emotions.

He was almost sorry when it ceased, though he welcomed the easier breathing and the sudden sense of freedom. Most of the other passengers started to unbuckle their safety straps, preparing to enjoy the thirty minutes of zero gravity during the transfer orbit, but a few who were obviously making the trip for the first time remained in their seats, looking around anxiously for the cabin attendants.

'Captain speaking. We're now at an altitude of three hundred kilometres, coming up over the west coast of Africa. You won't see much as it's night down there - that glow ahead is Sierra Leone - and there's a big tropical storm over the Gulf of Guinea. Look at those flashes!

'We'll have sunrise in fifteen minutes. Meanwhile I'm rolling the ship so you can get a good view of the equatorial satellite belt. The brightest one - almost straight overhead - is Intelsat's Atlantic-1 Antenna Farm. Then Intercosmos 2 to the west - that fainter star is Jupiter. And if you look just below that, you'll see a flashing light, moving against the star background - that's the new Chinese space-station. We pass within a hundred kilometres, not close enough to see anything with the naked eye -,

What were they up to? Floyd thought idly. He had examined the close-ups of the squat cylindrical structure with its curious bulges, and saw no reason to believe the alarmist rumours that it was a laser-equipped fortress. But while the Beijing Academy of Science ignored the UN Space Committee's repeated requests for a tour of inspection, the Chinese only had themselves to blame for such hostile propaganda.

The "Cosmonaut Alexei Leonov" was not a thing of beauty; but few spacecraft ever were. One day, perhaps, the human race would develop a new aesthetic; generations of artists might arise whose ideals were not based upon the natural forms of Earth moulded by wind and water. Space itself was a realm of often overpowering beauty; unfortunately, Man's hardware did not yet live up to it.

Apart from the four huge propellant tanks, which would be dropped off as soon as the transfer orbit was achieved, Leonov was surprisingly small. From heat shield to drive units was less than fifty metres; it was hard to believe that so modest a vehicle, smaller than many commercial aircraft, could carry ten men and women halfway across the Solar System.

But zero gravity, which made walls and roof and floor interchangeable, rewrote all the rules of living. There was plenty of room aboard Leonov even when everyone was awake at the same time, as was certainly the case at the moment. Indeed, her normal complement was at least doubled by assorted newsmen, engineers making final adjustments, and anxious officials.

As soon as the shuttle had docked, Floyd tried to find the cabin he would share - a year hence, when he awoke - with Curnow and Chandra. When he did locate it, he discovered that it was packed so tightly with neatly labelled boxes of equipment and provisions that entry was almost impossible. He was wondering glumly how to get a foot in the door when one of the crew, launching himself skilfully from handhold to handhold, noticed Floyd's dilemma and braked to a halt.

'Dr Floyd - welcome aboard. I'm Max Brailovsky - assistant engineer.'

The young Russian spoke the slow, careful English of a student who had had more lessons with an electronic tutor than a human teacher. As they shook hands, Floyd matched the face and name to the set of crew biographies he had already studied: Maxim Andreievitch Brailovsky, age thirty-one, born Leningrad, specializing in structure; hobbies: fencing, skycycling, chess.

'Glad to meet you,' said Floyd. 'But how do I get inside?'

'Not to worry,' said Max cheerfully. 'All that will be gone when you wake up. It's - what do you say? - expendables. We'll eat your room empty by the time you need it. I promise.' He patted his stomach.

'Fine - but meanwhile where do I put my things?' Floyd pointed to the three small cases, total mass fifty kilograms, which contained - he hoped - everything he needed for the next couple of billion kilometres. It had been no easy task, shepherding their weightless, but not inertialess, bulk through the ship's corridors with only a few collisions.

Max took two of the bags, glided gently through the triangle formed by three intersecting girders, and dived into a small hatchway, apparently defying Newton's First Law in the process. Floyd acquired a few extra bruises while following him; after a considerable time - Leonov seemed much bigger inside than out- they arrived at a door labelled CAPTAIN, in both Cyrillic and Roman. Although he could read Russian much better than he could speak it, Floyd appreciated the gesture; he had already noticed that all ship's notices were bilingual.

At Max's knock, a green light flashed on, and Floyd drifted inside as gracefully as he could. Though he had spoken to Captain Orlova many times, they had never before met. So he had two surprises.

It was impossible to judge a person's real size over the viewphone; the camera somehow converted everyone to the same scale. Captain Orlova, standing - as well as one could stand in zero gravity - barely reached to Floyd's shoulders. The viewphone had also completely failed to convey the penetrating quality of those dazzling blue eyes, much the most striking feature of a face that, at the moment, could not be fairly judged for beauty.

'Hello, Tanya,' said Floyd. 'How nice to meet at last. But what a pity about your hair.'

They grasped both hands, like old friends.

'And nice to have you aboard, Heywood!' answered the captain. Her English, unlike Brailovsky's, was quite fluent, though heavily accented. 'Yes, I was sorry to lose it - but hair's a nuisance on long missions, and I like to keep the local barbers away as long as possible. And my apologies about your cabin; as Max will have explained, we suddenly found we needed another ten cubic metres of storage space. Vasili and I won't be spending much time here for the next few hours - please feel free to use our quarters.'

'Thank you. What about Curnow and Chandra?'

'I've made similar arrangements with the crew. It may seem as if we're treating you like cargo -'

'Not wanted on voyage.'

'Pardon?'

'That's a label they used to put on the baggage, in the old days of ocean travel.'

Tanya smiled. 'It does look rather that way. But you'll be wanted all right, at the end of the trip. We're already planning your revival party.'

'That sounds too religious. Make it - no, resurrection would be even worse! - waking-up party. But I can see how busy you are - let me dump my things and continue my grand tour.'

'Max will show you around - take Dr Floyd to Vasili, will you? He's down in the drive unit.'

As they drifted out of the captain's quarters, Floyd gave mental good marks to the crew-selection committee. Tanya Orlova was impressive enough on paper; in the flesh she was almost intimidating, despite her charm. I wonder what she's like, Floyd asked himself, when she loses her temper. Would it be fire or ice? On the whole, I'd prefer not to find out.

Floyd was rapidly acquiring his space legs; by the time they reached Vasili Orlov, he was manoeuvring almost as confidently as his guide. The chief scientist greeted Floyd as warmly as his wife had.

'Welcome aboard, Heywood. How do you feel?'

'Fine, apart from slowly starving to death.'

For a moment Orlov looked puzzled; then his face split into a broad smile,

'Oh, I'd forgotten. Well, it won't be for long. In ten months' time, you can eat as much as you like.'

Hibernators went on a low-residue diet a week in advance; for the last twenty-four hours, they took nothing but liquid. Floyd was beginning to wonder how much of his increasing light-headedness was due to starvation, how much to Curnow's champagne, and how much to zero gravity.

To concentrate his mind, he scanned the multicoloured mass of plumbing that surrounded them.

'So this is the famous Sakharov Drive. It's the first time I've seen a full-scale unit.'

'It's only the fourth one ever built.'

'I hope it works.'

'It had better. Otherwise, the Gorky City Council will be renaming Sakharov Square again.'

It was a sign of the times that a Russian could joke, however wryly, about his country's treatment of its greatest scientist. Floyd was again reminded of Sakharov's eloquent speech to the Academy, when he was belatedly made Hero of the Soviet Union. Prison and banishment, he had told his listeners, were splendid aids to creativity; not a few masterpieces had been born within the walls of cells, beyond the reach of the world's distractions. For that matter, the greatest single achievement of the human intellect, the Principia itself, was a product of Newton's self-imposed exile from plague-ridden London.

The comparison was not immodest; from those years in Gorky had come not only new insights into the structure of matter and the origin of the Universe, but the plasma-controlling concepts that had led to practical thermonuclear power. The drive itself, though the best-known and most publicized outcome of that work, was merely one byproduct of that astonishing intellectual outburst. The tragedy was that such advances had been triggered by injustice; one day, perhaps, humanity would find more civilized ways of managing its affairs.

By the time they had left the chamber, Floyd had learned more about the Sakharov Drive than he really wished to know, or expected to remember. He was well acquainted with its basic principles - the use of a pulsed thermonuclear reaction to heat and expel virtually any propellant material. The best results were obtained with pure hydrogen as a working fluid, but that was excessively bulky and difficult to store over long periods of time. Methane and ammonia were acceptable alternatives; even water could be used, though with considerably poorer efficiency.

Leonov would compromise; the enormous liquid hydrogen tanks that provided the initial impetus would be discarded when the ship had attained the necessary speed to carry it to Jupiter. At the destination, ammonia would be used for the braking and rendezvous manoeuvres, and the eventual return to Earth.

That was the theory, checked and rechecked in endless tests and computer simulations. But as the ill-fated Discovery had shown so well, all human plans were subject to ruthless revision by Nature, or Fate, or whatever one preferred to call the powers behind the Universe.

'So there you are, Dr Floyd,' said an authoritative female voice, interrupting Vasili's enthusiastic explanation of magnetohydrodynamic feedback, 'Why didn't you report to me?'

Floyd rotated slowly on his axis by gently torquing himself with one hand. He saw a massive, maternal figure wearing a curious uniform adorned with dozens of pockets and pouches; the effect was not unlike that of a Cossack trooper draped with cartridge belts.

'Nice to meet you again, Doctor. I'm still exploring - I hope you've received my medical report from Houston.'

'Those vets at Teague! I wouldn't trust them to recognize foot-and-mouth disease!'

Floyd knew perfectly well the mutual respect felt between Katerina Rudenko and the Olin Teague Medical Center, even if the doctor's broad grin had not discounted her words. She saw his look of frank curiosity, and proudly fingered the webbing around her ample waist.

'The conventional little black bag isn't very practical in zero gravity - things float out of it and aren't there when you need them. I designed this myself, it's a complete minisurgery. With this, I could remove an appendix - or deliver a baby.'

'I trust that particular problem won't arise here.'

'Ha! A good doctor has to be ready for everything.'

What a contrast, thought Floyd, between Captain Orlova and Dr - or should he call her by her correct rank of Surgeon-Commander? - Rudenko. The captain had the grace and intensity of a prima ballerina; the doctor might have been the prototype of Mother Russia - stocky build, flat peasant face, needing only a shawl to complete the picture. Don't let that fool you, Floyd told himself. This is the woman who saved at least a dozen lives during the Komarov docking accident - and, in her spare time, manages to edit the Annals of Space Medicine. Consider yourself very lucky to have her aboard.

'Now, Dr Floyd, you're going to have plenty of time later to explore our little ship. My colleagues are too polite to say this, but they've work to do and you're in the way. I'd like to get you - all three of you - nice and peaceful as quickly as we can. Then we'll have less to worry about.'

'I was afraid of that, but I quite see your point of view. I'm ready as soon as you are.'

'I'm always ready. Come along - please.'

The ship's hospital was just large enough to hold an operating table, two exercise bicycles, a few cabinets of equipment, and an X-ray machine. While Dr

Rudenko was giving Floyd a quick but thorough examination, she asked unexpectedly: 'What's that little gold cylinder Dr Chandra carries on the chain around his neck - some kind of communications device? He wouldn't take it off - in fact, he was almost too shy to take anything off.'

Floyd could not help smiling; it was easy to imagine the modest Indian's reactions to this rather overwhelming lady.

'It's a lingam.'

'A what?'

'You're the doctor - you ought to recognize it. The symbol of male fertility.'

'Of course - stupid of me. Is he a practising Hindu? It's a little late to ask us to arrange a strict vegetarian diet.'

'Don't worry - we wouldn't have done that to you without fair warning. Though he won't touch alcohol, Chandra's not fanatical about anything except computers. He once told me that his grandfather was a priest in Benares, and gave him that lingam - it's been in the family for generations.'

Rather to Floyd's surprise, Dr Rudenko did not show the negative reaction he had expected; indeed, her expression became uncharacteristically wistful.

'I understand his feeling. My grandmother gave me a beautiful icon - sixteenth century. I wanted to bring it - but it weighs five kilos.'

The doctor became abruptly businesslike again, gave Floyd a painless injection with a gas-gun hypodermic, and told him to come back as soon as he was sleepy. That, she assured him, would be in less than two hours.

'Meanwhile, relax completely,' she ordered. 'There's an observation port on this level - Station D.6. Why don't you go there?'

It seemed a good idea, and Floyd drifted away with a docility that would have surprised his friends. Dr Rudenko glanced at her watch, dictated a brief entry into her autosec, and set its alarm thirty minutes ahead.

When he reached the D.6 viewport, Floyd found Chandra and Curnow already there. They looked at him with a total lack of recognition, then turned once more toward the awesome spectacle outside. It occurred to Floyd - and he congratulated himself on such a brilliant observation - that Chandra could not really be enjoying the view. His eyes were tightly closed,

A totally unfamiliar planet hung there, gleaming with glorious blues and dazzling whites. How strange, Floyd told himself. What has happened to the Earth? Why, of course - no wonder he didn't recognize it! It was upside down! What a disaster - he wept briefly for all those poor people, falling off into space..

He barely noticed when two crew members removed Chandra's unresisting form. When they came back for Curnow, Floyd's own eyes were shut, but he was still breathing. When they returned for him, even his breathing had ceased.

II

TSIEN

6

Awakening

And they told us we wouldn't dream, thought Heywood Floyd, more with surprise than annoyance. The glorious pink glow that surrounded him was very soothing; it reminded him of barbecues and the crackling logs of Christmas fire. But there was no warmth; indeed, he felt a distinct though not uncomfortable coldness.

Voices were murmuring, just too softly for him to understand the words. They became louder - but still he could not understand.

'Surely,' he said in sudden amazement, 'I can't be dreaming in Russian!'

'No, Heywood,' answered a woman's voice. 'You're not dreaming. It's time to get out of bed.'

The lovely glow faded; he opened his eyes, and had a blurred glimpse of a flashlight being withdrawn from his face. He was lying on a couch, held against it by elastic webbing; figures were standing around him, but they were too out of focus to identify.

Gentle fingers closed his eyelids and massaged his forehead.

'Don't exert yourself. Breathe deeply... again... that's right... now how do you feel?'

'I don't know... strange... light-headed... and hungry.'

'That's a good sign. Do you know where you are? You can open your eyes now.'

The figures came into focus - first Dr Rudenko, then Captain Orlova. But something had happened to Tanya since he had seen her, only an hour ago. When Floyd identified the cause, it was almost a physical shock.

'You've grown your hair back!'

'I hope you think it's an improvement. I can't say the same about your beard.'

Floyd lifted his hand to his face, finding that he had to make a conscious effort to plan every stage of the movement. His chin was covered with short stubble - a two or three days' growth. In hibernation, hair grew at only a hundredth of its normal rate.

'So I made it,' he said. 'We've arrived at Jupiter.'

Tanya looked at him sombrely, then glanced at the doctor, who gave a barely perceptible nod.

'No, Heywood,' she said. 'We're still a month away. Don't be alarmed - the ship's fine, and everything's running normally. But your friends in Washington have asked us to wake you up ahead of time. Something very unexpected has happened. We're in a race to reach Discovery - and I'm afraid we're going to lose.'

7

Tsien

When Heywood Floyd's voice came from the comset speaker, the two dolphins suddenly stopped circling around the pool and swam over to its edge. They placed their heads on the rim and stared intently at the source of the sound.

So they recognize Heywood, thought Caroline, with a twinge of bitterness: Yet Christopher, crawling around his playpen, did not even stop playing with the colour controls of his picture book as his father's voice came loud and clear across half a billion kilometres of space.

'... My dear, you won't be surprised to hear from me, a month ahead of schedule; you'll have known for weeks that we have company out here.

'I still find it hard to believe; in some ways, it doesn't even make sense. They can't possibly have enough fuel for a safe return to Earth; we don't even see how they can make the rendezvous.

'We never saw them, of course. Even at its closest, Tsien was more than fifty million kilometres away. They had plenty of time to answer our signals if they wanted to, but they ignored us completely. Now they'll be much too busy for friendly chat. In a few hours they'll hit Jupiter's atmosphere - and then we'll see how well their aerobraking system works. If it does its job, that will be good for our morale. But if it fails, well, let's not talk about that.

'The Russians are taking it remarkably well, all things considered. They're angry and disappointed, of course - but I've heard many expressions of frank admiration. It was certainly a brilliant trick, building that ship in full view and making everyone think it was a spacestation until they hitched on those boosters.

'Well, there's nothing we can do, except watch. And at our distance, we won't have a much better view than your best telescopes. I can't help wishing them luck, though of course I hope they leave Discovery alone. That's our property, and I bet the State Department's reminding them of it, every hour on the hour.

'It's an ill wind - if our Chinese friends hadn't jumped the gun on us, you wouldn't have heard from me for another month. But now that Dr Rudenko's woken me up, I'll be speaking to you every couple of days.

'After the initial shock, I'm settling down nicely- getting to know the ship and its crew, finding my space legs. And polishing up my lousy Russian, though I don't have much chance of using it - everyone insists on speaking English.

What shocking linguists we Americans are! I sometimes feel ashamed of our chauvinism - or our laziness.

'The standard of on-board English ranges from absolutely perfect - Chief Engineer Sasha Kovalev could earn a living as a BBC announcer - down to the if-you-talk-fast-enough-it-doesn't-matter-how-many-mistakes-you-make variety. The only one who isn't fluent is Zenia Marchenko, who replaced Irma Yakunina at the last moment. Incidentally, I'm glad to hear that Irma made a good recovery - what a disappointment that must have been! I wonder if she's started hang-gliding again.

'And speaking of accidents, it's obvious that Zenia must also have had a very bad one. Though the plastic surgeons have done a remarkable job, you can tell that she must have been severely burned at some time. She's the baby of the crew and the others treat her with - I was going to say pity, but that's too condescending. Let's say with special kindness.

'Maybe you're wondering how I get on with Captain Tanya. Well, I like her very much - but I'd hate to make her angry. There's no doubt exactly who runs this ship.

'And Surgeon-Commander Rudenko - you met her at the Honolulu Aerospace Convention two years ago, and I'm sure you won't have forgotten that last party. You'll understand why we all call her Catherine the Great - behind her broad back, of course.

'But that's enough gossip. If I run overtime, I hate to think of the surcharge. And by the way, these personal calls are supposed to be completely private. But there are a lot of links in the communications chain, so don't be surprised if you occasionally get messages by - well, another route.

'I'll be waiting to hear from you - tell the girls I'll be speaking to them later. My love to you all - I miss you and Chris very badly. And when I get back, I promise I'll never leave again.'

There was a brief hissing pause, then an obviously synthetic voice said: 'This terminates Transmission Four Hundred Thirty-two Stroke Seven from Spacecraft Leonov.' As Caroline Floyd switched off the speaker, the two dolphins slid beneath the surface of the pool and glided out into the Pacific, leaving scarcely a ripple in the water.

When he realized that his friends were gone, Christopher began to cry. His mother picked him up in her arms and tried to comfort him, but it was a long time before she succeeded.

8

Transit of Jupiter

The image of Jupiter, with its ribbons of white cloud, its mottled bands of salmon pink, and the Great Red Spot staring out like a baleful eye, hung steady on the flight-deck projection screen. It was three-quarters full, but no one was looking at the illuminated disk; all eyes were focused on the crescent of darkness at its edge. There, over the nightside of the planet, the Chinese ship was about to meet its moment of truth.

This is absurd, thought Floyd. We can't possibly see anything across forty million kilometres. And it doesn't matter; the radio will tell us all we want to know.

Tsien had closed down all voice, video, and data circuits two hours before, as the long-range antennas were withdrawn into the protective shadow of the heat shield. Only the omnidirectional beacon was still transmitting, accurately pinpointing the Chinese ship's position as it plunged toward that ocean of continent-sized clouds. The shrill beep... beep... beep... was the only sound in Leonov's control room. Each of those pulses had left Jupiter more than two minutes earlier; by this time, their source might already be a cloud of incandescent gas, dispersing in the Jovian stratosphere.

The signal was fading, becoming noisy. The beeps were getting distorted; several dropped out completely, then the sequence returned. A plasma sheath was building up around Tsien and soon would cut off all communications until the ship re-emerged. If it ever did.

'Posmotri!' cried Max. 'There it is!'

At first Floyd could see nothing. Then, just off the edge of the illuminated disk, he made out a tiny star - gleaming where no star could possibly be, against the darkened face of Jupiter.

It appeared quite motionless, though he knew it must be moving at a hundred kilometres a second. Slowly it grew in brilliance; and then it was no longer a dimensionless point, but was becoming elongated. A man-made comet was streaking across the Jovian night sky, leaving a trail of incandescence thousands of kilometres in length.

One last badly distorted and curiously drawn-out beep sounded from the tracking beacon, then only the meaningless hiss of Jupiter's own radiation, one of those many cosmic voices that had nothing to do with Man or his works.

Tsien was inaudible, but not yet invisible. For they could see that the tiny elongated spark had indeed moved appreciably away from the sunward face of the planet and would soon disappear into the nightside. By then, if all had gone according to plan, Jupiter would have captured the ship, destroying its unwanted velocity. When it emerged from behind the giant world, it would be another Jovian satellite.

The spark flickered out. Tsien had rounded the curve of the planet and was heading over the nightside. There would be nothing to see, or to hear, until it emerged from shadow - if all went well, in just under an hour. It would be a very long hour for the Chinese.

To Chief Scientist Vasili Orlov and communications engineer Sasha Kovalev, the hour went extremely quickly. There was much they could learn from

observations of that little star; its times of appearance and disappearance and, above all, the Doppler shift of the radio beacon gave vital information about Tsien's new orbit. Leonov's computers were already digesting the figures, and spitting out projected times of re-emergence based on various assumptions about rates of deceleration in the Jovian atmosphere.

Vasili switched off the computer display, spun around in his chair, loosened his seat belt, and addressed the patiently waiting audience.

'Earliest reappearance is in forty-two minutes. Why don't you spectators go for a walk, so we can concentrate on getting all this into good shape? See you in thirty-five minutes. Shoo! Nu ukhodi!'

Reluctantly, the unwanted bodies left the bridge - but, to Vasili's disgust, everyone was back again in little more than thirty minutes. He was still chiding them for their lack of faith in his calculations when the familiar beep... beep... beep... of Tsien's tracking beacon burst from the loudspeakers.

Vasili looked astonished and mortified, but soon joined in the spontaneous round of applause; Floyd could not see who first started the clapping. Rivals though they might be, they were all astronauts together, as far from home as any men had ever travelled - 'Ambassadors for Mankind', in the noble words of the first UN Space Treaty. Even if they did not want the Chinese to succeed, neither did they wish them to meet disaster.

A large element of self-interest was also involved, Floyd could not help thinking. Now the odds in Leonov's own favour were significantly improved; Tsien had demonstrated that the aerobraking manoeuvre was indeed possible. The data on Jupiter was correct; its atmosphere did not contain unexpected and perhaps fatal surprises.

'Well!' said Tanya. 'I suppose we should send them a message of congratulations. But even if we did, they wouldn't acknowledge it.'

Some of his colleagues were still making fun of Vasili, who was staring at his computer output in frank disbelief.

'I don't understand it!' he exclaimed. 'They should still be behind Jupiter! Sasha - give me a velocity reading on their beacon!'

Another silent dialogue was held with the computer; then Vasili gave a long, low whistle.

'Something's wrong. They're in a capture orbit, all right - but it won't let them make a rendezvous with Discovery. The orbit they're on now will take them way beyond Io - I'll have more accurate data when we've tracked them for another five minutes.'

'Anyway, they must be in a safe orbit,' said Tanya. 'They can always make corrections later.'

'Perhaps. But that could cost them days, even if they have the fuel. Which I doubt.'

'So we may still beat them.'

'Don't be such an optimist. We're still three weeks from Jupiter. They can make a dozen orbits before we get there, and choose the most favourable one for a rendezvous.'

'Again - assuming that they have enough propellant.'

'Of course. And that's something we can only make educated guesses about.'

All this conversation took place in such rapid and excited Russian that Floyd was left far behind. When Tanya took pity on him and explained that Tsien had overshot and was heading for the outer satellites, his first reaction was: 'Then they may be in serious trouble. What will you do if they appeal for help?'

'You must be making a joke. Can you imagine them doing that? They're much too proud. Anyway, it would be impossible. We can't change our mission profile, as you know perfectly well. Even if we had the fuel...'

'You're right, of course; but it might be difficult to explain that to the ninety-nine per cent of the human race that doesn't understand orbital mechanics. We should start thinking about some of the political complications - it would look bad for all of us if we can't help. Vasili, will you give me their final orbit, as soon as you've worked it out? I'm going down to my cabin to do some homework.'

Floyd's cabin, or rather one-third of a cabin, was still partly full of stores, many of them stacked in the curtained bunks that would be occupied by Chandra and Curnow when they emerged from their long slumbers. He had managed to clear a small working space for his personal effects and had been promised the luxury of another whole two cubic metres - just as soon as someone could be spared to help with the furniture removing.

Floyd unlocked his little communications console, set the decryption keys, and called for the information on Tsien that had been transmitted to him from Washington. He wondered if his hosts had had any luck in unscrambling it; the cipher was based on the product of two hundred-digit prime numbers, and the National Security Agency had staked its reputation on the claim that the fastest computer in existence could not crack it before the Big Crunch at the end of the Universe. It was a claim that could never be proved - only disproved.

Once again he stared intently at the excellent photographs of the Chinese ship, taken when it had revealed its true colours and was just about to leave Earth orbit. There were later shots - not so clear, because by then it had been far away from the prying cameras - of the final stage as it hurtled toward Jupiter. Those were the ones that interested him most; even more useful were the cutaway drawings and estimates of performance.

Granted the most optimistic assumptions, it was difficult to see what the Chinese hoped to do. They must have burned up at least ninety per cent of their propellant in that mad dash across the Solar System. Unless it was literally a suicide mission - something that could not be ruled out - only a plan involving hibernation and later rescue made any sense. And Intelligence did not believe that Chinese hibernation technology was sufficiently far advanced to make that a viable option.

But Intelligence was frequently wrong, and even more often confused by the avalanche of raw facts it had to evaluate - the 'noise' in its information circuits. It had done a remarkable job on Tsien, considering the shortness of

time, but Floyd wished that the material sent to him had been more carefully filtered. Some of it was obvious junk, of no possible connection with the mission.

Nevertheless, when you did not know what you were looking for, it was important to avoid all prejudices and preconceptions; something that at first sight seemed irrelevant, or even nonsensical, might turn out to be a vital clue.

With a sigh, Floyd started once more to skim the five hundred pages of data, keeping his mind as blankly receptive as possible while diagrams, charts, photographs - some so smudgy that they could represent almost anything - news items, lists of delegates to scientific conferences, titles of technical publications, and even commercial documents scrolled swiftly down the high-resolution screen. A very efficient industrial espionage system had obviously been extremely busy; who would have thought that so many Japanese holomemory modules or Swiss gas-flow microcontrollers or German radiation detectors could have been traced to a destination in the dried lake bed of Lop Nor - the first milepost on their way to Jupiter?

Some of the items must have been included by accident; they could not possibly relate to the mission. If the Chinese had placed a secret order for one thousand infrared sensors through a dummy corporation in Singapore, that was only the concern of the military; it seemed highly unlikely that Tsien expected to be chased by heat-seeking missiles. And this one was really funny - specialized surveying and prospecting equipment from Glacier Geophysics, Inc., of Anchorage, Alaska. What lamebrain imagined that a deep-space expedition would have any need - the smile froze on Floyd's lips; he felt the skin crawl on the back of his neck. My God - they wouldn't dare! But they had already dared greatly; and now, at last, everything made sense.

He flashed back to the photos and conjectured plans of the Chinese ship. Yes, it was just conceivable - those flutings at the rear, alongside the drive deflection electrodes, would be about the right size.

Floyd called the bridge. 'Vasili.' he said, 'have you worked out their orbit yet?'

'Yes, I have,' the navigator replied, in a curiously subdued voice. Floyd could tell at once that something had turned up. He took a long shot.

'They're making a rendezvous with Europa, aren't they?'

There was an explosive gasp of disbelief from the other end.

'Chyort voz'mi! How did you know?'

'I didn't - I've just guessed it.'

'There can't be any mistake - I've checked the figures to six places. The braking manoeuvre worked out exactly as they intended. They're right on course for Europa - it couldn't have happened by chance. They'll be there in seventeen hours.'

'And go into orbit.'

'Perhaps; it wouldn't take much propellant. But what would be the point?'

'I'll risk another guess. They'll do a quick survey - and then they'll land.'

'You're crazy - or do you know something we don't?'

'No - it's just a matter of simple deduction. You're going to start kicking yourself for missing the obvious.'

'Okay, Sherlock, why should anyone want to land on Europa? What's there, for heaven's sake?'

Floyd was enjoying his little moment of triumph. Of course, he might still be completely wrong.

'What's on Europa? Only the most valuable substance in the Universe.'

He had overdone it; Vasili was no fool, and snatched the answer from his lips.

'Of course - water!'

'Exactly. Billions and billions of tons of it. Enough to fill up the propellant tanks - go cruising around all the satellites, and still have plenty left for the rendezvous with Discovery and the voyage home. I hate to say this, Vasili - but our Chinese friends have outsmarted us again.

'Always assuming, of course, that they can get away with it.'

9

The Ice of the Grand Canal

Apart from the jet-black sky, the photo might have been taken almost anywhere in the polar regions of Earth; there was nothing in the least alien about the sea of wrinkled ice that stretched all the way out to the horizon. Only the five spacesuited figures in the foreground proclaimed that the panorama was of another world.

Even now, the secretive Chinese had not released the names of the crew. The anonymous intruders on the frozen Europan icescape were merely the chief scientist, the commander, the navigator, the first engineer, the second engineer. It was also ironic, Floyd could not help thinking, that everyone on Earth had seen the already historic photograph an hour before it reached Leonov, so much closer to the scene. But Tsien's transmissions were relayed on such a tight beam that it was impossible to intercept them; Leonov could receive only its beacon, broadcasting impartially in all directions. Even that was inaudible more than half the time, as Europa's rotation carried it out of sight, or the satellite itself was eclipsed by the monstrous bulk of Jupiter. All the scanty news of the Chinese mission had to be relayed from Earth.

The ship had touched down, after its initial survey, on one of the few islands of solid rock that protruded through the crust of ice covering virtually the entire moon. That ice was flat from pole to pole; there was no weather to

carve it into strange shapes, no drifting snow to build up layer upon layer into slowly moving hills. Meteorites might fall upon airless Europa, but never a flake of snow. The only forces moulding its surface were the steady tug of gravity, reducing all elevations to one uniform level, and the incessant quakes caused by the other satellites as they passed and repassed Europa in their orbits. Jupiter itself, despite its far greater mass, had much less effect. The Jovian tides had finished their work aeons ago, ensuring that Europa remained locked forever with one face turned toward its giant master.

All this had been known since the Voyager flyby missions of the 1970s, the Galileo surveys of the 1980s, and the Kepler landings of the 1990s. But, in a few hours, the Chinese had learned more about Europa than all the previous missions combined. That knowledge they were keeping to themselves; one might regret it, but few would deny that they had earned the right to do so.

What was being denied, with greater and greater asperity, was their right to annex the satellite. For the first time in history, a nation had laid claim to another world, and all the news media of Earth were arguing over the legal position. Though the Chinese pointed out, at tedious length, that they had never signed the '02 UN Space Treaty and so were not bound by its provisions, that did nothing to quell the angry protests.

Suddenly, Europa was the biggest news in the Solar System. And the man-on-the-spot (at least to the nearest few million kilometres) was in great demand.

'This is Heywood Floyd, aboard Cosmonaut Alexei Leonov, on course for Jupiter. But as you can well imagine, all our thoughts are now focused upon Europa.

'At this very moment I'm looking at it through the most powerful of the ship's telescopes; under this magnification, it's ten times larger than the Moon as you see it with the naked eye. And it's a really weird sight.

'The surface is a uniform pink, with a few small brown patches. It's covered with an intricate network of narrow lines, curling and weaving in all directions. In fact, it looks very much like a photo from a medical textbook, showing a pattern of veins and arteries.

'A few of these features are hundreds - or even thousands - of kilometres long, and look rather like the illusory canals that Percival Lowell and other early-twentieth-century astronomers imagined they'd seen on Mars.

'But Europa's canals aren't an illusion, though of course they're not artificial. What's more, they do contain water -or at least ice. For the satellite is almost entirely covered by ocean, averaging fifty kilometres deep.

'Because it's so far from the sun, Europa's surface temperature is extremely low - about a hundred and fifty degrees below freezing. So one might expect its single ocean to be a solid block of ice.

'Surprisingly, that isn't the case because there's a lot of heat generated inside Europa by tidal forces - the same forces that drive the great volcanoes on neighbouring Io.

'So the ice is continually melting, breaking up, and freezing, forming cracks and lanes like those in the floating ice sheets in our own polar regions. It's that intricate tracery of cracks I'm seeing now; most of them are dark and very ancient - perhaps millions of years old. But a few are almost pure white; they're the new ones that have just opened up, and have a crust only a few centimetres thick.

'Tsien has landed right beside one of these white streaks -the fifteen-hundred-kilometre-long feature that's been christened the Grand Canal. Presumably the Chinese intend to pump its water into their propellant tanks, so that they can explore the Jovian satellite system and then return to Earth. That may not be easy, but they'll certainly have studied the landing site with great care, and must know what they're doing.

'It's obvious, now, why they've taken such a risk - and why they should claim Europa. As a refuelling point, it could be the key to the entire outer Solar System. Though there's also water on Ganymede, it's all frozen, and also less accessible because of that satellite's more powerful gravity.

'And there's another point that's just occurred to me. Even if the Chinese do get stranded on Europa, they might be able to survive until a rescue mission is arranged. They have plenty of power, there may be useful minerals in the area - and we know that the Chinese are the experts on synthetic-food production. It wouldn't be a very luxurious life; but I have some friends who would accept it happily for that staggering view of Jupiter sprawled across the sky - the view we expect to see ourselves, in just a few days.

'This is Heywood Floyd, saying goodbye for my colleagues and myself, aboard Alexei Leonov.'

'And this is the bridge. Very nice presentation, Heywood. You should have been a newsman.'

'I've had plenty of practice. Half my time was spent on PR work.'

'PR?'

'Public relations - usually telling politicians why they should give me more money. Something you don't have to bother about.'

'How I wish that was true. Anyway, come up to the bridge. There's some new information we'd like to discuss with you.'

Floyd removed his button microphone, locked the telescope into position and extricated himself from the tiny viewing blister. As he left, he almost collided with Nikolai Temovsky, obviously on a similar mission.

'I'm about to steal your best quotes for Radio Moscow, Woody. Hope you don't mind.'

'You're welcome, tovarishch. Anyway, how could I stop you?'

Up on the bridge, Captain Orlova was looking thoughtfully at a dense mass of words and figures on the main display. Floyd had painfully started to transliterate them when she interrupted him.

'Don't worry about the details. These are estimates of the time it will take for Tsien to refill its tanks and get ready for lift-off.'

'My people are doing the same calculations - but there are far too many variables.'

'We think we've removed one of them. Did you know that the very best water pumps you can buy belong to fire brigades? And would you be surprised to learn that the Beijing Central Station had four of its latest models suddenly requisitioned a few months ago, despite the protests of the mayor?'

'I'm not surprised - merely lost in admiration. Go on, please.'

'That may be a coincidence, but those pumps would be just the right size. Making educated guesses about pipe deployment, drilling through the ice and so on - well, we think they could lift off again in five days.'

'Five days!'

'If they're lucky, and everything works perfectly. And if they don't wait to fill their propellant tanks but merely take on just enough for a safe rendezvous with Discovery before we do. Even if they beat us by a single hour, that would be enough. They could claim salvage rights, at the very least.'

'Not according to the State Department's lawyers. At the appropriate moment, we'll declare that Discovery is not a derelict, but has merely been parked until we can retrieve it. Any attempt to take over the ship would be an act of piracy.'

'I'm sure the Chinese will be most impressed.'

'If they're not, what can we do about it?'

'We outnumber them - and two to one, when we revive Chandra and Curnow.'

'Are you serious? Where are the cutlasses for the boarding party?'

'Cutlasses?'

'Swords - weapons.'

'Oh. We could use the laser telespectrometer. That can vaporize milligram asteroid samples at ranges of a thousand kilometres.'

'I'm not sure that I like this conversation. My government certainly would not condone violence, except of course in self-defence.'

'You naive Americans! We're more realistic; we have to be. All your grandparents died of old age, Heywood. Three of mine were killed in the Great Patriotic War.'

When they were alone together, Tanya always called him Woody, never Heywood. She must be serious. Or was she merely testing his reactions?

'Anyway, Discovery is merely a few billion dollars' worth of hardware. The ship's not important - only the information it carries.'

'Exactly. Information that could be copied, and then erased.'

'You do get some cheerful ideas, Tanya. Sometimes I think that all Russians are a little paranoiac.'

'Thanks to Napoleon and Hitler, we've earned every right to be. But don't tell me that you haven't already worked out that - what do you call it, scenario? - for yourself.'

'It wasn't necessary,' Floyd answered rather glumly. 'The State Department's already done it for me - with variations. We'll just have to see which one the Chinese come up with. And I wouldn't be in the least surprised if they outguess us again.'

10

A Cry from Europa

Sleeping in zero gravity is a skill that has to be learned; it had taken Floyd almost a week to find the best way of anchoring legs and arms so that they did not drift into uncomfortable positions. Now he was an expert, and was not looking forward to the return of weight; indeed, the very idea gave him occasional nightmares.

Someone was shaking him awake. No - he must still be dreaming! Privacy was sacred aboard a spaceship; nobody ever entered another crew member's chambers without first asking permission. He clenched his eyes shut, but the shaking continued.

'Dr Floyd - please wake up! You're wanted on the flight deck!'

And nobody called him Dr Floyd; the most formal salutation he had received for weeks was Doc. What was happening?

Reluctantly, he opened his eyes. He was in his tiny cabin, gently gripped by his sleeping cocoon. So one part of his mind told him; then why was he looking at - Europa? They were still millions of kilometres away.

There were the familiar reticulations, the patterns of triangles and polygons formed by intersecting lines. And surely that was the Grand Canal itself - no, it wasn't quite right. How could it be, since he was still in his little cabin aboard Leonov?

'Dr Floyd!'

He became fully awake, and realized that his left hand was floating just a few centimetres in front of his eyes. How strange that the pattern of lines across the palm was so uncannily like the map of Europa! But economical Mother Nature was always repeating herself, on such vastly different scales as the swirl of milk stirred into coffee, the cloud lanes of a cyclonic storm, the arms of a spiral nebula.

'Sorry, Max,' he said. 'What's the problem? Is something wrong?'

'We think so - but not with us. Tsien's in trouble.'

Captain, navigator, and chief engineer were strapped in their seats on the flight deck; the rest of the crew orbited anxiously around convenient handholds, or watched on the monitors.

'Sorry to wake you up, Heywood,' Tanya apologized brusquely. 'Here's the situation. Ten minutes ago we had a Class One Priority from Mission Control. Tsien's gone off the air. It happened very suddenly, in the middle of a cipher message; there were a few seconds of garbled transmission - then nothing.'

'Their beacon?'

'That's stopped as well. We can't receive it either,'

'Phew! Then it must be serious - a major breakdown. Any theories?'

'Lots - but all guesswork. An explosion - landslide - earthquake: who knows?'

'And we may never know - until someone else lands on Europa - or we do a close flyby and take a look.'

Tanya shook her head. 'We don't have enough delta-vee. The closest we could get is fifty thousand kilometres. Not much you could see from that distance.'

'Then there's absolutely nothing we can do.'

'Not quite, Heywood. Mission Control has a suggestion. They'd like us to swing our big dish around, just in case we can pick up any weak emergency transmissions. It's - how do you say? - a long shot, but worth trying. What do you think?'

Floyd's first reaction was strongly negative.

'That will mean breaking our link with Earth.'

'Of course; but we'll have to do that anyway, when we go around Jupiter. And it will only take a couple of minutes to re-establish the circuit.'

Floyd remained silent. The suggestion was perfectly reasonable, yet it worried him obscurely. After puzzling for several seconds, he suddenly realized why he was so opposed to the idea.

Discovery's troubles had started when the big dish - the main antenna complex - had lost its lock on Earth, for reasons which even now were not completely clear. But Hal had certainly been involved, and there was no danger of a similar situation arising here. Leonov's computers were small, autonomous units; there was no single controlling intelligence. At least, no nonhuman one.

The Russians were still waiting patiently for his answer.

'I agree,' he said at last. 'Let Earth know what we're doing, and start listening. I suppose you'll try all the SPACE MAYDAY frequencies.'

'Yes, as soon as we've worked out the Doppler corrections. How's it going, Sasha?'

'Give me another two minutes, and I'll have the automatic search running. How long should we listen?'

The captain barely paused before giving her answer. Floyd had often admired Tanya Orlova's decisiveness, and had once told her so. In a rare flash of humour, she had replied: 'Woody, a commander can be wrong, but never uncertain.'

'Listen for fifty minutes, and report back to Earth for ten. Then repeat the cycle.'

There was nothing to see or hear; the automatic circuits were better at sifting the radio noise than any human senses. Nevertheless, from time to time Sasha turned up the audio monitor, and the roar of Jupiter's radiation belts filled the cabin. It was a sound like the waves breaking on all the beaches of Earth, with occasional explosive cracks from superbolts of lightning in the Jovian atmosphere. Of human signals, there was no trace; and, one by one, the members of the crew not on duty drifted quietly away.

While he was waiting, Floyd did some mental calculations. Whatever had happened to Tsien was already two hours in the past, since the news had been relayed from Earth.

But Leonov should be able to pick up a direct message after less than a minute's delay, so the Chinese had already had ample time to get back on the air. Their continued silence suggested some catastrophic failure, and he found himself weaving endless scenarios of disaster.

The fifty minutes seemed like hours. When they were up, Sasha swung the ship's antenna complex back toward Earth, and reported failure. While he was using the rest of the ten minutes to send a backlog of messages, he looked inquiringly at the captain.

'Is it worth trying again?' he said in a voice that clearly expressed his own pessimism.

'Of course. We may cut back the search time - but we'll keep listening.'

On the hour, the big dish was once more focused upon Europa. And almost at once, the automatic monitor started flashing its ALERT light.

Sasha's hand darted to the audio gain, and the voice of Jupiter filled the cabin. Superimposed upon that, like a whisper heard against a thunderstorm, was the faint but completely unmistakable sound of human speech. It was impossible to identify the language, though Floyd felt certain, from the intonation and rhythm, that it was not Chinese, but some European tongue.

Sasha played skilfully with fine-tuning and band-width controls, and the words became clearer. The language was undoubtedly English - but its content was still maddeningly unintelligible.

There is one combination of sounds that every human ear can detect instantly, even in the noisiest environment. When it suddenly emerged from the Jovian background, it seemed to Floyd that he could not possibly be awake, but was trapped in some fantastic dream. His colleagues took a little longer to

react; then they stared at him with equal amazement - and a slowly dawning suspicion.

- For the first recognizable words from Europa were: 'Dr Floyd - Dr Floyd - I hope you can hear me.'

11

Ice and Vacuum

'Who is it?' whispered someone, to a chorus of shushes. Floyd raised his hands in a gesture of ignorance - and, he hoped, innocence.

'... know you are aboard Leonov... may not have much time... aiming my suit antenna where I think...' The signal vanished for agonizing seconds, then came back much clearer, though not appreciably louder.

'... relay this information to Earth. Tsien destroyed three hours ago. I'm only survivor. Using my suit radio - no idea if it has enough range, but it's the only chance. Please listen carefully. THERE IS LIFE ON EUROPA. I repeat: THERE IS LIFE ON EUROPA.'

The signal faded again. A stunned silence followed that no one attempted to interrupt. While he was waiting, Floyd searched his memory furiously. He could riot recognize the voice - it might have been that of any Western-educated Chinese. Probably it was someone he had met at a scientific conference, but unless the speaker identified himself he would never know.

'... soon after local midnight. We were pumping steadily and the tanks were almost half full. Dr Lee and I went out to check the pipe insulation. Tsien stands - stood - about thirty metres from the edge of the Grand Canal. Pipes go directly from it and down through the ice. Very thin - not safe to walk on. The warm upwelling...'

Again a long silence. Floyd wondered if the speaker was moving, and had been momentarily cut off by some obstruction.

'... no problem - five kilowatts of lighting strung up on the ship. Like a Christmas tree - beautiful, shining right through the ice. Glorious colours. Lee saw it first - a huge dark mass rising up from the depths. At first we thought it was a school of fish - too large for a single organism - then it started to break through the ice.

'Dr Floyd, I hope you can hear me. This is Professor Chang - we met in '02 - Boston IAU conference.'

Instantly, incongruously, Floyd's thoughts were a billion kilometres away. He vaguely remembered that reception, after the closing session of the International Astronomical Union Congress - the last one that the Chinese had attended before the Second Cultural Revolution. And now he recalled Chang very distinctly - a small, humorous astronomer and exobiologist with a good fund of jokes. He wasn't joking now.

'... like huge strands of wet seaweed, crawling along the ground. Lee ran back to the ship to get a camera - I stayed to watch, reporting over the radio. The thing moved so slowly I could easily outrun it. I was much more excited than alarmed. Thought I knew what kind of creature it was - I've seen pictures of the kelp forests off California - but I was quite wrong.

'I could tell it was in trouble. It couldn't possibly survive at a temperature a hundred and fifty below its normal environment. It was freezing solid as it moved forward - bits were breaking off like glass - but it was still advancing toward the ship, a black tidal wave, slowing down all the time.

'I was still so surprised that I couldn't think straight and I couldn't imagine what it was trying to do...'

'Is there any way we can call him back?' Floyd whispered urgently.

'No - it's too late. Europa will soon be behind Jupiter. We'll have to wait until it comes out of eclipse.'

'... climbing up the ship, building a kind of ice tunnel as it advanced. Perhaps this was insulating it from the cold - the way termites protect themselves from the sunlight with their little corridors of mud.

'... tons of ice on the ship. The radio antennas broke off first. Then I could see the landing legs beginning to buckle - all in slow motion, like a dream.

'Not until the ship started to topple did I realize what the thing was trying to do - and then it was too late. We could have saved ourselves - if we'd only switched off those lights.

'Perhaps it's a phototrope, its biological cycle triggered by the sunlight that filters through the icc, Or it could have been attracted like a moth to a candle. Our floodlights must have been more brilliant than anything that Europa has ever known.

'Then the ship crashed. I saw the hull split, a cloud of snowflakes form as moisture condensed. All the lights went out, except for one, swinging back and forth on a cable a couple of metres above the ground.

'I don't know what happened immediately after that. The next thing I remember, I was standing under the light, beside the wreck of the ship, with a fine powdering of fresh snow all around me. I could see my footsteps in it very clearly. I must have run there; perhaps only a minute or two had elapsed.

'The plant - I still thought of it as a plant - was motionless. I wondered if it had been damaged by the impact; large sections - as thick as a man's arm - had splintered off, like broken twigs.

'Then the main trunk started to move again. It pulled away from the hull, and began to crawl toward me. That was when I knew for certain that the thing was light-sensitive: I was standing immediately under the thousand watt lamp, which had stopped swinging now.

'Imagine an oak tree - better still, a banyan with its multiple trunks and roots - flattened out by gravity and trying to creep along the ground. It got to within five metres of the light, then started to spread out until it had made a

perfect circle around me. Presumably that was the limit of its tolerance - the point at which photo-attraction turned to repulsion. After that, nothing happened for several minutes. I wondered if it was dead - frozen solid at last.

'Then I saw that large buds were forming on many of the branches. It was like watching a time-lapse film of flowers opening. In fact I thought they were flowers - each about as big as a man's head.

'Delicate, beautifully coloured membranes started to unfold. Even then, it occurred to me that no one - no thing - could ever have seen these colours before; they had no existence until we brought our lights - our fatal lights - to this world.

'Tendrils, stamens, waving feebly... I walked over to the living wall that surrounded me, so that I could see exactly what was happening. Neither then, nor at any other time, had I felt the slightest fear of the creature. I was certain that it was not malevolent - if indeed it was conscious at all.

'There were scores of the big flowers, in various stages of unfolding. Now they reminded me of butterflies, just emerging from the chrysalis - wings crumpled, still feeble - I was getting closer and closer to the truth.

'But they were freezing - dying as quickly as they formed. Then, one after another, they dropped off from the parent buds. For a few moments they flopped around like fish stranded on dry land - at last I realized exactly what they were. Those membranes weren't petals - they were fins, or their equivalent. This was the free-swimming, larval stage of the creature. Probably it spends much of its life rooted on the seabed, then sends these mobile offspring in search of new territory. Just like the corals of Earth's oceans.

'I knelt down to get a closer look at one of the little creatures. The beautiful colours were fading now to a drab brown. Some of the petal-fins had snapped off, becoming brittle shards as they froze. But it was still moving feebly, and as I approached it tried to avoid me. I wondered how it sensed my presence.

'Then I noticed that the stamens - as I'd called them - all carried bright blue dots at their tips. They looked like tiny star sapphires - or the blue eyes along the mantle of a scallop - aware of light, but unable to form true images. As I watched, the vivid blue faded, the sapphires became dull, ordinary stones.

'Dr Floyd - or anyone else, who is listening - I haven't much more time; Jupiter will soon block my signal. But I've almost finished.

'I knew then what I had to do. The cable to that thousand watt lamp was hanging almost to the ground. I gave it a few tugs, and the light went out in a shower of sparks.

'I wondered if it was too late. For a few minutes, nothing happened. So I walked over to the wall of tangled branches around me, and kicked it.

'Slowly, the creature started to unweave itself, and to retreat back to the Canal. There was plenty of light - I could see everything perfectly. Ganymede and Callisto were in the sky - Jupiter was a huge, thin crescent - and there was a big auroral display on the nightside, at the Jovian end of the Io flux tube. There was no need to use my helmet light.

'I followed the creature all the way back to the water, encouraging it with more kicks when it slowed down, feeling the fragments of ice crunching all the time beneath my boots... as it neared the Canal, it seemed to gain strength and energy, as if it knew that it was approaching its natural home. I wondered if it would survive, to bud again.

'It disappeared through the surface, leaving a few last dead larvae on the alien land. The exposed free water bubbled for a few minutes until a scab of protective ice sealed it from the vacuum above. Then I walked back to the ship to see if there was anything to salvage - I don't want to talk about that.

'I've only two requests to make, Doctor. When the taxonomists classify this creature, I hope they'll name it after me.

'And - when the next ship comes home - ask them to take our bones back to China.

'Jupiter will be cutting us off in a few minutes. I wish I knew whether anyone was receiving me. Anyway, I'll repeat this message when we're in line of sight again - if my suit's life-support system lasts that long.

'This is Professor Chang on Europa, reporting the destruction of spaceship Tsien. We landed beside the Grand Canal and set up our pumps at the edge of the ice -,

The signal faded abruptly, came back for a moment, then disappeared completely be1ow the noise level. Although Leonov listened again on the same frequency, there was no further message from Professor Chang.

III

DISCOVERY

12

Downhill Run

The ship was gaining speed at last, on the downhill run toward Jupiter. It had long since passed the gravitational no-man's-land where the four tiny outer moons - Sinope, Pasiphae, Ananke, and Carme - wobbled along their retrograde and wildly eccentric orbits. Undoubtedly captured asteroids, and completely irregular in shape, the largest was only thirty kilometres across. Jagged, splintered rocks of no interest to anyone except planetary geologists, their allegiance wavered continually between the Sun and Jupiter. One day, the Sun would recapture them completely.

But Jupiter might retain the second group of four, at half the distance of the others. Elara, Lysithea, Himalia, and Leda were fairly close together, and lying in almost the same plane. There was speculation that they had once been part of a single body; if so, the parent would have been barely a hundred kilometres across.

Though only Carme and Leda came close enough to show disks visible to the naked eye, they were greeted like old friends. Here was the first landfall after the longest ocean voyage - the offshore islands of Jupiter. The last hours were ticking away; the most critical phase of the entire mission was approaching - the entry into the Jovian atmosphere.

Jupiter was already larger than the Moon in the skies of Earth, and the giant inner satellites could be clearly seen moving around it. They all showed noticeable disks and distinctive colouring, though they were still too far away for any markings to be visible. The eternal ballet they performed - disappearing behind Jupiter, reappearing to transit the daylight face with their accompanying shadows - was an endlessly engaging spectacle. It was one that astronomers had watched ever since Galileo had first glimpsed it almost exactly four centuries ago; but the crew of Leonov were the only living men and women to have seen it with unaided eyes.

The interminable chess games had ceased; off-duty hours were spent at the telescopes, or in earnest conversation, or listening to music, usually while gazing at the view outside. And at least one shipboard romance had reached a culmination: the frequent disappearances of Max Brailovsky and Zenia Marchenko were the subject of much good-natured banter.

They were, thought Floyd, an oddly matched pair. Max was a big, handsome blond who had been a champion gymnast, reaching the finals of the 2000 Olympics. Though he was in his early thirties, he had an open-faced, almost boyish expression. This was not altogether misleading; despite his brilliant engineering record, he often struck Floyd as naive and unsophisticated - one of those people who are pleasant to talk to, but not for too long. Outside his own field of undoubted expertise he was engaging but rather shallow.

Zenia - at twenty-nine, the youngest on board - was still something of a mystery. Since no one wished to talk about it, Floyd had never raised the subject of her injuries, and his Washington sources could provide no information. Obviously she had been involved in some serious accident, but it might have been nothing more unusual than a car crash. The theory that she had been on a secret space mission - still part of popular mythology outside the USSR - could be ruled out. Thanks to the global tracking networks, no such thing had been possible for fifty years.

In addition to her physical and doubtless psychological scars, Zenia laboured under yet another handicap. She was a last-minute replacement, and everyone knew it. Irma Yakunina was to have been dietician and medical assistant aboard Leonov before that unfortunate argument with a hang-glider broke too many bones.

Every day at 1800 GMT the crew of seven plus one passenger gathered in the tiny common room that separated the flight deck from the galley and sleeping quarters. The circular table at its centre was just big enough for eight people to squeeze around; when Chandra and Curnow were revived, it would be unable to accommodate everyone, and two extra seats would have to be fitted in somewhere else.

Though the 'Six O'Clock Soviet', as the daily round-table conference was called, seldom lasted more than ten minutes, it played a vital role in maintaining morale. Complaints, suggestions, criticisms, progress reports -

anything could be raised, subject only to the captain's overriding veto, which was very seldom exercised.

Typical items on the non-existent agenda were requests for changes in the menu, appeals for more private communication time with Earth, suggested movie programmes, exchange of news and gossip, and good-natured needling of the heavily-outnumbered American contingent. Things would change, Floyd warned them, when his colleagues came out of hibernation, and the odds improved from I in 7 to 3 in 9. He did not mention his private belief that Curnow could outtalk or outshout any three other people aboard.

When he was not sleeping, much of Floyd's own time was spent in the common room - partly because, despite its smallness, it was much less claustrophobic than his own tiny cubicle. It was also cheerfully decorated, all available flat surfaces being covered with photos of beautiful land and seascapes, sporting events, portraits of popular videostars, and other reminders of Earth. Pride of place, however, was given to an original Leonov painting - his 1965 study 'Beyond the Moon', made in the same year when, as a young lieutenant-colonel, he left Voskhod II and became the first man in history to perform an extravehicular excursions

Clearly the work of a talented amateur, rather than a professional, it showed the cratered edge of the Moon with the beautiful Sinus lridum - Bay of Rainbows - in the foreground. Looming monstrously above the lunar horizon was the thin crescent of Earth, embracing the darkened nightside of the planet. Beyond that blazed the Sun, the streamers of the corona reaching out into space for millions of kilometres around it.

It was a striking composition - and a glimpse of the future that even then lay only three years ahead. On the flight of Apollo 8, Anders, Borman and Lovell were to see this splendid sight with their unaided eyes, as they watched Earth rise above the farside on Christmas Day, 1968.

Heywood Floyd admired the painting, but he also regarded it with mixed feelings. He could not forget that it was older than everybody else on the ship - with one exception.

He was already nine years old when Alexei Leonov had painted it.

13

The Worlds of Galileo

Even now, more than three decades after the revelations of the first Voyager flybys, no one really understood why the four giant satellites differed so wildly from one another. They were all about the same size, and in the same part of the Solar System - yet they were totally dissimilar, as if children of a different birth.

Only Callisto, the outermost, had turned out to be much as expected. When Leonov raced past at a distance of just over 100,000 kilometres, the larger of its countless craters were clearly visible to the naked eye. Through the telescope, the satellite looked like a glass ball that had been used as a target

by high-powered rifles; it was completely covered with craters of every size, right down to the lower limit of visibility. Callisto, someone had once remarked, looked more like Earth's Moon than did the Moon itself.

Nor was this particularly surprising. One would have expected a world out here - at the edge of the asteroid belt - to have been bombarded with the debris left over from the creation of the Solar System. Yet Ganymede, the satellite next door, had a totally different appearance. Though it had been well peppered with impact craters in the remote past, most of them had been ploughed over - a phrase that seemed peculiarly appropriate. Huge areas of Ganymede were covered with ridges and furrows, as if some cosmic gardener had dragged a giant rake across them. And there were light-coloured streaks, like trails that might have been made by slugs fifty kilometres across. Most mysterious of all were long, meandering bands, containing dozens of parallel lines. It was Nikolai Ternovsky who decided what they must be - multilane superhighways, laid out by drunken surveyors. He even claimed to have detected over-passes and cloverleaf intersections.

Leonov had added some trillions of bits of information about Ganymede to the store of human knowledge, before it crossed the orbit of Europa. That icebound world, with its derelict and its dead, was on the other side of Jupiter, but it was never far from anyone's thoughts.

Back on Earth, Dr Chang was already a hero and his countrymen had, with obvious embarrassment, acknowledged countless messages of sympathy. One had been sent in the name of Leonov's crew - after, Floyd gathered, considerable redrafting in Moscow. The feeling on board the ship was ambiguous - a mixture of admiration, regret, and relief. All astronauts, irrespective of their national origins, regarded themselves as citizens of space and felt a common bond, sharing each other's triumphs and tragedies. No one on Leonov was happy because the Chinese expedition had met with disaster; yet at the same time, there was a muted sense of relief that the race had not gone to the swiftest.

The unexpected discovery of life on Europa had added a new element to the situation - one that was now being argued at great length both on Earth and aboard Leonov. Some exobiologists cried 'I told you so!', pointing out that it should not have been such a surprise after all. As far back as the 1970s, research submarines had found teeming colonies of strange marine creatures thriving precariously in an environment thought to be equally hostile to life - the trenches on the bed of the Pacific. Volcanic springs, fertilizing and warming the abyss, had created oases of life in the deserts of the deep.

Anything that had happened once on Earth should be expected millions of times elsewhere in the Universe; that was almost an article of faith among scientists. Water - or at least ice - occurred on all the moons of Jupiter. And there were continuously erupting volcanoes on Io - so it was reasonable to expect weaker activity on the world next door. Putting these two facts together made Europan life seem not only possible, but inevitable - as most of nature's surprises are, when viewed with 20/20 hindsight.

Yet that conclusion raised another question, and one vital to Leonov's mission. Now that life had been discovered on the moons of Jupiter - did it have any connection with the Tycho monolith, and the still more mysterious artifact in orbit near Io?

That was a favourite subject to debate in the Six O'Clock Soviets. It was generally agreed that the creature encountered by Dr Chang did not represent a

high form of intelligence - at least, if his interpretation of its behaviour was correct. No animal with even elementary powers of reasoning would have allowed itself to become a victim of its instincts, attracted like a moth to the candle until it risked destruction.

Vasili Orlov was quick to give a counter-example that weakened, if it did not refute, that argument.

'Look at whales and dolphins,' he said. 'We call them intelligent - but how often they kill themselves in mass strandings! That looks like a case where instinct overpowers reason.'

'No need to go to the dolphins,' interjected Max Brailovsky. 'One of the brightest engineers in my class was fatally attracted to a blonde in Kiev. When I heard of him last, he was working in a garage. And he'd won a gold medal for designing spacestations. What a waste!'

Even if Dr Chang's Europan was intelligent, that of course did not rule out higher forms elsewhere. The biology of a whole world could not be judged from a single specimen.

But it had been widely argued that advanced intelligence could never arise in the sea; there were not enough challenges in so benign and unvarying an environment. Above all, how could marine creatures ever develop a technology without the aid of fire?

Yet perhaps even that was possible; the route that humanity had taken was not the only one. There might be whole civilizations in the seas of other worlds.

Still, it seemed unlikely that a space-faring culture could have arisen on Europa without leaving unmistakable signs of its existence in the form of buildings, scientific installations, launching sites, or other artifacts. But from pole to pole, nothing could be seen but level ice and a few outcroppings of bare rock.

No time remained for speculations and discussions when Leonov hurtled past the orbits of Io and tiny Mimas. The crew was busy almost non-stop, preparing for the encounter and the brief onset of weight after months in free-fall. All loose objects had to be secured before the ship entered Jupiter's atmosphere, and the drag of deceleration produced momentary peaks that might be as high as two gravities.

Floyd was lucky; he alone had time to admire the superb spectacle of the approaching planet, now filling almost half the sky. Because there was nothing to give it scale, there was no way that the mind could grasp its real size. He had to keep telling himself that fifty Earths would not cover the hemisphere now turned toward him.

The clouds, colourful as the most garish sunset on Earth, raced so swiftly that he could see appreciable movement in as little as ten minutes. Great eddies were continually forming along the dozen or so bands that girdled the planet, then rippling away like swirls of smoke. Plumes of white gas occasionally geysered up from the depths, to be swept away by the gales caused by the planet's tremendous spin. And perhaps strangest of all were the white spots, sometimes spaced as regularly as pearls on a necklace, which lay along the tradewinds of the middle Jovian latitudes.

In the hours immediately before encounter, Floyd saw little of captain or navigator. The Orlovs scarcely left the bridge, as they continually checked the approach orbit and made minute refinements to Leonov's course. The ship was now on the critical path that would just graze the outer atmosphere; if it went too high, frictional braking would not be sufficient to slow it down, and it would go racing out of the Solar System, beyond all possibility of rescue. If it went too low, it would burn up like a meteor. Between the two extremes lay little margin for error.

The Chinese had proved that aerobraking could be done, but there was always the chance that something would go wrong: So Floyd was not at all surprised when Surgeon-Commander Rudenko admitted, just an hour before contact: 'I'm beginning to wish, Woody, that I had brought along that icon, after all.'

14

Double Encounter

'... papers for the mortgage on the Nantucket house should be in the file marked M in the library.

'Well, that's all the business I can think of. For the last couple of hours I've been recalling a picture I saw as a boy, in a tattered volume of Victorian art - it must have been almost one hundred and fifty years old. I can't remember whether it was black-and-white or colour. But I'll never forget the title - don't laugh - it was called "The Last Message Home". Our great-great-grandfathers loved that kind of sentimental melodrama.

'It shows the deck of a windjammer in a hurricane - the sails have been ripped away and the deck's awash. In the background, the crew is struggling to save the ship. And in the foreground, a young sailor boy's writing a note, while beside him is the bottle he hopes will carry it to land.

'Even though I was a kid at the time, I felt he should have been giving his shipmates a hand, not writing letters. All the same, it moved me: I never thought that one day I'd be like that young sailor.

'Of course, I'm sure you'll get this message-and there's nothing I can do to help aboard Leonov. In fact, I've been politely requested to keep out of the way, so my conscience is quite clear as I dictate this.

'I'll send it up to the bridge now because in fifteen minutes we'll break transmission as we pull in the big dish and batten down the hatches - there's another nice maritime analogy for you! Jupiter's filling the sky now - I won't attempt to describe it and won't even see it much longer because the shutters will go up in a few minutes. Anyway, the cameras can do far better than I could.

'Goodbye, my dearest, and my love to you all - especially Chris. By the time you get this, it will be over, one way or the other. Remember I tried to do my best for all our sakes - goodbye.'

When he had removed the audio chip, Floyd drifted up to the communications centre and handed it over to Sasha Kovalev.

'Please make sure it gets off before we close down,' he said earnestly.

'Don't worry,' promised Sasha. 'I'm still working on all channels, and we have a good ten minutes left.'

He held out his hand. 'If we do meet again, why, we shall smile! If not, why then, this parting was well made.' Floyd blinked.

'Shakespeare, I suppose?'

'Of course; Brutus and Cassius before battle. See you later.'

Tanya and Vasili were too intent upon their situation displays to do more than wave to Floyd, and he retreated to his cabin. He had already said farewell to the rest of the crew; there was nothing to do but wait. His sleeping bag was slung in preparation for the return of gravity when deceleration commenced, and he had only to climb into it - 'Antennas retracted, all protective shields up,' said the intercom speaker. 'We should feel first braking in five minutes. Everything normal.'

'That's hardly the word I'd use,' Floyd muttered to himself. 'I think you mean "nominal".' He had barely concluded the thought when there was a diffident knock on the door.

'Kto tam?'

To his astonishment, it was Zenia.

'Do you mind if I come in?' she asked awkwardly, in a small-girl voice which Floyd could scarcely recognize.

'Of course not. But why aren't you in your own cubicle? It's only five minutes to re-entry.'

Even as he asked the question, he was aware of its foolishness. The answer was so perfectly obvious that Zenia did not deign to reply.

But Zenia was the very last person he would have expected: her attitude toward him had invariably been polite but distant. Indeed, she was the only member of the crew who preferred to call him Dr Floyd. Yet there she was, clearly seeking comfort and companionship at the moment of peril.

'Zenia, my dear,' he said wryly. 'You're welcome. But my accommodation is somewhat limited. One might even call it Spartan.'

She managed a faint smile, but said nothing as she floated into the room. For the first time, Floyd realized that she was not merely nervous - she was terrified. Then he understood why she had come to him. She was ashamed to face her countrymen and was looking for support elsewhere.

With this realization, his pleasure at the unexpected encounter abated somewhat. That did not lessen his responsibility to another lonely human being, a long way from home. The fact that she was an attractive - though certainly not

beautiful - woman of barely half his own age should not have affected the issue. But it did; he was beginning to rise to the occasion.

She must have noticed, but did nothing to encourage or discourage him as they lay down side by side in the sleeping cocoon. There was just enough room for them both, and Floyd began to do some anxious calculations. Suppose maximum gee was higher than predicted, and the suspension gave way? They could easily be killed...

There was an ample safety margin; no need to worry about such an ignominious end. Humour was the enemy of desire; their embrace was now completely chaste. He was not sure whether to be glad or sorry.

And it was too late for second thoughts. From far, far away came the first faint whisper of sound, like the wailing of some lost soul. At the same moment, the ship gave a barely perceptible jerk; the cocoon began to swing around and its suspension tightened. After weeks of weightlessness, gravity was returning.

Within seconds, the faint wail had risen to a steady roar, and the cocoon had become an overloaded hammock. This is not such a good idea, Floyd thought to himself, already it was difficult to breathe. The deceleration was only a part of the problem: Zenia was clutching him as a drowning person is supposed to clutch the proverbial straw.

He detached her as gently as he could.

'It's all right, Zenia. If Tsien did it, so can we. Relax - don't worry.'

It was difficult to shout tenderly, and he was not even sure if Zenia heard him above the roar of incandescent hydrogen. But she was no longer clutching him quite so desperately, and he seized the opportunity of taking a few deep breaths.

What would Caroline think if she could see him now? Would he tell her if he ever had the chance? He was not sure she would understand. At a moment like that, all links with Earth seemed very tenuous indeed.

It was impossible to move, or to speak, but now that he had grown accustomed to the strange sense of weight he was no longer uncomfortable - except for the increasing numbness in his right arm. With some difficulty, he managed to extricate it from beneath Zenia; the familiar act brought a fleeting sense of guilt. As he felt his circulation returning, Floyd remembered a famous remark attributed to at least a dozen astronauts and cosmonauts: 'Both the pleasures and problems of zero-gravity sex have been greatly exaggerated.'

He wondered how the rest of the crew was faring, and he gave a momentary thought to Chandra and Curnow, sleeping peacefully through it all. They would never know if Leonov became a meteor shower in the Jovian sky. He did not envy them; they had missed the experience of a lifetime.

Tanya was speaking over the intercom; her words were lost in the roar, but her voice sounded calm and perfectly normal, just as if she was making a routine announcement. Floyd managed to glance at his watch, and was astonished to see that they were already at the midpoint of the braking manoeuvre. At that very moment, Leonov was at its closest approach to Jupiter; only expendable automatic probes had gone deeper into the Jovian atmosphere.

'Halfway through, Zenia,' he shouted. 'On the way out again.' He could not tell if she understood. Her eyes were tightly closed, but she smiled slightly.

The ship was now rocking noticeably, like a small boat in a choppy sea. Was that normal? wondered Floyd. He was glad that he had Zenia to worry about; it took his mind away from his own fears. Just for a moment, before he managed to expel the thought, he had a vision of the walls suddenly glowing cherry red, and caving in upon him. Like the nightmare fantasy of Edgar Allan Poe's 'The Pit and the Pendulum', which he'd forgotten for thirty years.

But that would never happen. If the heat shield failed, the ship would crumble instantly, hammered flat by a solid wall of gas. There would be no pain; his nervous system would not have time to react before it ceased to exist. He had experienced more consoling thoughts, but this one was not to be despised.

The buffeting slowly weakened. There was another inaudible announcement from Tanya (he would pull her leg about that, when it was all over). Now time seemed to be going much more slowly; after a while he stopped looking at his watch, because he could not believe it. The digits changed so slowly that he could almost imagine himself in some Einsteinian time dilation.

And then something even more unbelievable happened. First he was amused, then slightly indignant. Zenia had fallen asleep - if not exactly in his arms, then at least beside them.

It was a natural reaction: the strain must have exhausted her, and the wisdom of the body had come to her rescue. And suddenly Floyd himself became aware of an almost post-orgasmic drowsiness, as if he too had been emotionally drained by the encounter. He had to fight to remain awake.

And then he was falling... falling... falling... it was all over. The ship was back in space, where it belonged. And he and Zenia were floating apart.

They would never again be so close together, but they would always know a special tenderness toward each other, which no one else could ever share.

15

Escape from the Giant

When Floyd reached the observation deck - a discreet few minutes after Zenia - Jupiter already seemed farther away. But that must be an illusion based on his knowledge, not the evidence of his eyes. They had barely emerged from the Jovian atmosphere, and the planet still filled half the sky.

And now they were - as intended - its prisoners. During the last incandescent hour, they had deliberately jettisoned the excess speed that could have carried them right out of the Solar System, and on to the stars. Now they were travelling in an ellipse - a classical Hohmann orbit - which would shuttle them back between Jupiter and the orbit of Io, 350,000 kilometres higher. If they did not - or could not - fire their motors again, Leonov would swing back and forth between these limits, completing one revolution every nineteen hours. It would become the closest of Jupiter's moons - though not for long. Each time

it grazed the atmosphere it would lose altitude, until it spiralled into destruction.

Floyd had never really enjoyed vodka, but he joined the others without any reservations in drinking a triumphant toast to the ship's designers, coupled with a vote of thanks to Sir Isaac Newton. Then Tanya put the bottle firmly back in its cupboard; there was still much to be done.

Though they were all expecting it, everyone jumped at the sudden muffled thud of explosive charges, and the jolt of separation. A few seconds later, a large, still-glowing disk floated into view, slowly turning end-over-end as it drifted away from the ship.

'Look!' cried Max. 'A flying saucer! Who's got a camera?' There was a distinct note of hysterical relief in the laughter that followed. It was interrupted by the captain, in a more serious vein.

'Goodbye, faithful heat shield! You did a wonderful job.'

'But what a waste!' said Sasha. 'There's at least a couple of tons left, Think of all the extra payload we could have carried!'

'If that's good, conservative Russian engineering,' retorted Floyd, 'then I'm all for it. Far better a few tons too much - than one milligram too little.'

Everyone applauded those noble sentiments as the jetti soned shield cooled to yellow, then red, and finally became as black as the space around it. It vanished from sight while only a few kilometres away, though occasionally the sudden reappearance of an eclipsed star would betray its presence.

'Preliminary orbit check completed,' said Vasili. 'We're within ten metres a second of our right vector. Not bad for a first try.'

There was a subdued sigh of relief at the news, and a few minutes later Vasili made another announcement.

'Changing attitude for course correction; delta vee six metres a second. Twenty-second burn coming up in one minute.'

They were still so close to Jupiter it was impossible to believe that the ship was orbiting the planet; they might have been in a high-flying aircraft that had just emerged from a sea of clouds. There was no sense of scale; it was easy to imagine that they were speeding away from some terrestrial sunset; the reds and pinks and crimsons sliding below were so familiar.

And that was an illusion; nothing here had any parallels with Earth. Those colours were intrinsic, not borrowed from the setting sun. The very gases were utterly alien - methane and ammonia and a witch's brew of hydrocarbons, stirred in a hydrogen-helium cauldron. Not one trace of free oxygen, the breath of human life.

The clouds marched from horizon to horizon in parallel rows, distorted by occasional swirls and eddies. Here and there upwellings of brighter gas broke the pattern, and Floyd could also see the dark rim of a great whirlpool, a maelstrom of gas leading down into unfathomable Jovian depths.

He began to look for the Great Red Spot, then quickly checked himself at such a foolish thought. All the enormous cloudscape he could see below would be only a few per cent of the Red Spot's immensity; one might as well expect to recognize the shape of the United States from a small aeroplane flying low above Kansas.

'Correction completed. We're now on interception orbit with Io. Arrival time: eight hours, fifty-five minutes.'

Less than nine hours to climb up from Jupiter and meet whatever is waiting for us, thought Floyd. We've escaped from the giant - but he represents a danger we understood, and could prepare for. What lies ahead now is utter mystery.

And when we have survived that challenge, we must return to Jupiter once again. We shall need his strength to send us safely home.

16

Private Line

'... Hello, Dimitri. This is Woody, switching to Key Two in fifteen seconds... Hello, Dimitri - multiply Keys Three and Four, take cube root, add pi squared and use nearest integer as Key Five. Unless your computers are a million times faster than ours - and I'm damn sure they're not - no one can decrypt this, on your side or mine. But you may have some explaining to do; anyway, you're good at that.

'By the way, my usual excellent sources told me about the failure of the latest attempt to persuade old Andrei to resign; I gather that your delegation had no more luck than the others, and you're still saddled with him as President. I'm laughing my head off; it serves the Academy right. I know he's over ninety, and growing a bit - well, stubborn. But you won't get any help from me, even though I'm the world's - sorry, Solar System's - leading expert on the painless removal of elderly scientists.

'Would you believe that I'm still slightly drunk? We felt we deserved a little party, once we'd successfully rendez - rendezvous, damn, rendezvoused with Discovery. Besides, we had two new crew members to welcome aboard. Chandra doesn't believe in alcohol - it makes you too human - but Walter Curnow more than made up for him, Only Tanya remained stone-cold sober, just as you'd expect.

'My fellow Americans - I sound like a politician, God help me - came out of hibernation without any problems, and are both looking forward to starting work. We'll all have to move quickly; not only is time running out, but Discovery seems to be in very bad shape. We could hardly believe our eyes when we saw how its spotless white hull had turned a sickly yellow.

'Io's to blame, of course. The ship's spiralled down to within three thousand kilometres, and every few days one of the volcanoes blasts a few megatons of sulphur up into the sky. Even though you've seen the movies, you can't really imagine what it's like to hang above that inferno; I'll be glad

when we can get away, even though we'll be heading for something much more mysterious - and perhaps far more dangerous.

'I flew over Kilauea during the '06 eruption; that was mighty scary, but it was nothing - nothing - compared to this. At the moment, we're over the nightside, and that makes it worse. You can see just enough to imagine a lot more. It's as close to Hell as I ever want to get.

'Some of the sulphur lakes are hot enough to glow, but most of the light comes from electrical discharges. Every few minutes the whole landscape seems to explode, as if a giant photoflash has gone off above it. And that's probably not a bad analogy; there are millions of amps flowing in the flux-tube linking Io and Jupiter, and every so often there's a breakdown. Then you get the biggest lightning flash in the Solar System, and half our circuit-breakers jump out in sympathy.

'There's just been an eruption right on the terminator, and I can see a huge cloud expanding up toward us, climbing into the sunlight. I doubt if it will reach our altitude, and even if it does it will be harmless by the time it gets here. But it looks ominous - a space monster, trying to devour us.

'Soon after we got here, I realized that Io reminded me of something; it took me a couple of days to work it out, and then I had to check with Mission Archives because the ship's library couldn't help - shame on it. Do you remember how I introduced you to The Lord of the Rings, when we were kids back at that Oxford conference? Well, Io is Mordor: look up Part Three. There's a passage about "rivers of molten rock that wound their way... until they cooled and lay like twisted dragon-shapes vomited from the tormented earth." That's a perfect description: how did Tolkien know, a quarter century before anyone ever saw a picture of Io? Talk about Nature imitating Art.

'At least we won't have to land there: I don't think that even our late Chinese colleagues would have attempted that. But perhaps one day it may be possible; there are areas that seem fairly stable, and not continually inundated by sulphur floods.

'Who would have believed that we'd come all the way to Jupiter, greatest of planets - and then ignore it. Yet that's what we're doing most of the time; and when we're not looking at Io or Discovery, we're thinking about the Artifact.

'It's still ten thousand kilometres away, up there at the libration point, but when I look at it through the main telescope it seems close enough to touch. Because it's so completely featureless, there's no indication of size, no way the eye can judge it's really a couple of kilometres long. If it's solid, it must weigh billions of tons.

'But is it solid? It gives almost no radar echo, even when it's square-on to us. We can see it only as a black silhouette against the clouds of Jupiter, three hundred thousand kilometres below. Apart from its size, it looks exactly like the monolith we dug up on the Moon.

'Well, tomorrow we'll go aboard Discovery, and I don't know when I'll have time or opportunity to speak to you again. But there's one more thing, old friend, before I sign off.

'It's Caroline. She's never really understood why I had to leave Earth, and in a way I don't think she'll ever quite forgive me. Some women believe, that

love isn't the only thing - but everything. Perhaps they're right... anyway, it's certainly too late to argue now.

'Try and cheer her up when you have a chance. She talks about going back to the mainland. I'm afraid that if she does...

'If you can't get through to her, try to cheer up Chris. I miss him more than I care to say.

'He'll believe Uncle Dimitri - if you say that his father still loves him, and will be coming home just as quickly as he can.'

17

Boarding Party

Even in the best of circumstances, it is not easy to board a derelict and uncooperative spaceship. Indeed, it can be positively dangerous.

Walter Curnow knew that as an abstract principle; but he did not really feel it in his bones until he saw the entire hundred-metre length of Discovery turning end-over-end, while Leonov kept at a safe distance. Years ago, friction had braked the spin of Discovery's carousel, thus transferring its angular momentum to the rest of the structure. Now, like a drum-majorette's baton at the height of its trajectory, the abandoned ship was slowly tumbling along its orbit.

The first problem was to stop that spin, which made Discovery not only uncontrollable but almost unapproachable. As he suited up in the airlock with Max Brailovsky, Curnow had a very rare sensation of incompetence, even inferiority; it was not his line of business. He had already explained gloomily, 'I'm a space engineer, not a space monkey'; but the job had to be done. He alone possessed the skills that could save Discovery from Io's grasp. Max and his colleagues, working with unfamiliar circuit diagrams and equipment, would take far too long. By the time they had restored power to the ship and mastered its controls, it would have plunged into the sulphurous firepits below.

'You're not scared, are you?' asked Max, when they were about to put on their helmets.

'Not enough to make a mess in my suit. Otherwise, yes.' Max chuckled. 'I'd say that's about right for this job. But don't worry - I'll get you there in one piece, with my - what do you call it?'

'Broomstick. Because witches are supposed to ride them.'

'Oh yes. Have you ever used one?'

'I tried once, but mine got away from me. Everyone else thought it was very funny.'

There are some professions which have evolved unique and characteristic tools - the longshoreman's hook, the potter's wheel, the bricklayer's trowel,

the geologist's hammer. The men who had to spend much of their time on zero-gravity construction projects had developed the broomstick.

It was very simple - a hollow tube just a metre long, with a footpad at one end and a retaining loop at the other. At the touch of a button, it could telescope out to five or six times its normal length, and the internal shock-absorbing system allowed a skilled operator to perform the most amazing manoeuvres. The footpad could also become a claw or hook if necessary; there were many other refinements, but that was the basic design. It looked deceptively easy to use; it wasn't.

The airlock pumps finished recycling; the EXIT sign came on; the outer doors opened, and they drifted slowly into the void.

Discovery was windmilling about two hundred metres away, following them in orbit around Io, which filled half the sky. Jupiter was invisible, on the other side of the satellite. This was a matter of deliberate choice; they were using Io as a shield to protect them from the energies raging back and forth in the flux-tube that linked the two worlds. Even so, the radiation level was dangerously high; they had less than fifteen minutes before they must get back to shelter.

Almost immediately, Curnow had a problem with his suit. 'It fitted me when I left Earth,' he complained. 'But now I'm rattling around inside like a pea in a pod.'

'That's perfectly normal, Walter,' said Surgeon-Commander Rudenko, breaking into the radio circuit. 'You lost ten kilos in hibernation, which you could very well afford to miss. And you've already put three of them back.'

Before Curnow had time to think of a suitable retort, he found himself gently but firmly jerked away from Leonov.

'Just relax, Walter,' said Brailovsky. 'Don't use your thrusters, even if you start tumbling. Let me do all the work.'

Curnow could see the faint puffs from the younger man's backpack, as its tiny jets drove them toward Discovery. With each little cloud of vapour there came a gentle tug on the towline, and he would start moving toward Brailovsky; but he never caught up with him before the next puff came. He felt rather like a yo-yo - now making one of its periodic comebacks on Earth - bouncing up and down on its string.

There was only one safe way to approach the derelict, and that was along the axis around which it was slowly revolving. Discovery's centre of rotation was approximately amidships, near the main antenna complex, and Brailovsky was heading directly toward this area, with his anxious partner in tow. How will he stop both of us in time? Curnow asked himself.

Discovery was now a huge, slender dumbbell slowly flailing the entire sky ahead of them. Though it took several minutes to complete one revolution, the far ends were moving at an impressive speed. Curnow tried to ignore them, and concentrated on the approaching - and immobile - centre.

'I'm aiming for that,' said Brailovsky. 'Don't try to help, and don't be surprised at anything that happens.'

Now, what does he mean by that? Curnow asked himself, while preparing to be as unsurprised as possible.

Everything happened in about five seconds. Brailovsky triggered his broomstick, so that it telescoped out to its full length of four metres and made contact with the approaching ship. The broomstick started to collapse, its internal spring absorbing Brailovsky's considerable momentum; but it did not, as Curnow had fully expected, bring him to rest beside the antenna mount. It immediately expanded again, reversing the Russian's velocity so that he was, in effect, reflected away from Discovery just as rapidly as he had approached. He flashed past Curnow, heading out into space again, only a few centimetres away. The startled American just had time to glimpse a large grin before Brailovsky shot past him.

A second later, there was a jerk on the line connecting them, and a quick surge of deceleration as they shared momentum. Their opposing velocities had been neatly cancelled; they were virtually at rest with respect to Discovery. Curnow had merely to reach out to the nearest handhold, and drag them both in.

'Have you ever tried Russian roulette?' he asked, when he had got his breath back.

'No - what is it?'

'I must teach you sometime. It's almost as good as this for curing boredom.'

'I hope you're not suggesting, Walter, that Max would do anything dangerous?'

Dr Rudenko sounded as if she was genuinely shocked, and Curnow decided it was best not to answer; sometimes the Russians did not understand his peculiar sense of humour. 'You could have fooled me,' he muttered under his breath, not loud enough for her to hear.

Now that they were firmly attached to the hub of the windmilling ship, he was no longer conscious of its rotation - especially when he fixed his gaze upon the metal plates immediately before his eyes. The ladder stretching away into the distance, running along the slender cylinder that was Discovery's main structure, was his next objective. The spherical command module at its far end seemed several light-years away, though he knew perfectly well that the distance was only fifty metres.

'I'll go first,' said Brailovsky, reeling in the slack on the line linking them together. 'Remember - it's downhill all the way from here. But that's no problem - you can hold on with one hand. Even at the bottom, gravity's only about a tenth gee. And that's - what do you say? - chickenshit.'

'I think you mean chickenfeed. And if it's all the same to you, I'm going feet first. I never liked crawling down ladders the wrong way up - even in fractional gravity.'

It was essential, Curnow was very well aware, to keep up this gently bantering tone; otherwise he would be simply overwhelmed by the mystery and danger of the situation. There he was, almost a billion kilometres from home, about to enter the most famous derelict in the entire history of space exploration; a media reporter had once called Discovery the Marie Celeste of space, and that was not a bad analogy. But there was also much that made his

situation unique; even if he tried to ignore the nightmare moonscape filling half the sky, there was a constant reminder of its presence at hand. Every time he touched the rungs of the ladder, his glove dislodged a thin mist of sulphur dust.

Brailovsky, of course, was quite correct; the rotational gravity caused by the ship's end-over-end tumbling was easily countered. As he grew used to it, Curnow even welcomed the sense of direction it gave him.

And then, quite suddenly, they had reached the big, discoloured sphere of Discovery's control and life-support module. Only a few metres away was an emergency hatch - the very one, Curnow realized, that Bowman had entered for his final confrontation with Hal.

'Hope we can get in,' muttered Brailovsky. 'Pity to come all this way and find the door locked.'

He scraped away the sulphur obscuring the AIRLOCK STATUS display panel.

'Dead, of course. Shall I try the controls?'

'Won't do any harm - but nothing will happen.'

'You're right. Well, here goes with manual...

It was fascinating to watch the narrow hairline open in the curved wall, and to note the little puff of vapour dispersing into space, carrying with it a scrap of paper. Was that some vital message? They would never know; it spun away, tumbling end over end without losing any of its initial spin as it disappeared against the stars.

Brailovsky kept turning the manual control for what seemed a very long time, before the dark, uninviting cave of the airlock was completely open. Curnow had hoped that the emergency lights, at least, might still be operating. No such luck.

'You're boss now, Walter. Welcome to US territory.'

It certainly did not look very welcoming as he clambered inside, flashing the beam of his helmet light around the interior. As far as Curnow could tell, everything was in good order. What else had he expected? he asked himself, half angrily.

Closing the door manually took even longer than opening it, but there was no alternative until the ship was powered up again. Just before the hatch was sealed, Curnow risked a glance at the insane panorama outside.

A flickering blue lake had opened up near the equator; he was sure it had not been there a few hours earlier. Brilliant yellow flares, the characteristic colour of glowing sodium, were dancing along its edges; and the whole of the nightland was veiled in the ghostly plasma discharge of one of Io's almost continuous auroras.

It was the stuff of future nightmares - and as if that was not sufficient, there was one further touch worthy of a mad surrealist artist. Stabbing up into the black sky, apparently emerging directly from the firepits of the burning

moon, was an immense, curving horn, such as a doomed bullfighter might have glimpsed in the final moment of truth.

The crescent of Jupiter was rising to greet Discovery and Leonov as they swept toward it along their common orbit.

18

Salvage

The moment that the outer hatch had closed behind them, there had been a subtle reversal of roles. Curnow was at home now, while Brailovsky was out of his element, feeling ill at ease in the labyrinth of pitch-black corridors and tunnels that was Discovery's interior. In theory, Max knew his way round the ship, but that knowledge was based only on a study of its design drawings. Curnow, on the other hand, had spent months working in Discovery's still uncompleted identical twin; he could, quite literally, find his way around blindfolded.

Progress was made difficult because that part of the ship was designed for zero gee; now the uncontrolled spin provided an artificial gravity, which, slight though it was, always seemed to be in the most inconvenient direction.

'First thing we've got to do,' muttered Curnow, after sliding several metres down a corridor before he could grab a handhold, 'is to stop this damned spin. And we can't do that until we have power. I only hope that Dave Bowman safeguarded all systems before he abandoned ship.'

'Are you sure he did abandon the ship? He may have intended to come back.'

'You may be right; I don't suppose we'll ever know. If he even knew himself.'

They had now entered the Pod Bay - Discovery's 'space garage', which normally contained three of the spherical one-man modules used for activities outside the ship. Only Pod Number 3 remained; Number 1 had been lost in the mysterious accident that had killed Frank Poole - and Number 2 was with Dave Bowman, wherever he might be.

The Pod Bay also contained two spacesuits, looking uncomfortably like decapitated corpses as they hung helmet-less in their racks. It needed very little effort of the imagination - and Brailovsky's was now working overtime - to fill them with a whole menagerie of sinister occupants.

It was unfortunate, but not altogether surprising, that Curnow's sometimes irresponsible sense of humour got the better of him at this very moment.

'Max,' he said, in a tone of deadly seriousness, 'whatever happens - please don't go chasing off after the ship's cat.'

For a few milliseconds, Brailovsky was thrown off guard; he almost answered: 'I do wish you hadn't said that, Walter', but checked himself in time. That

would have been too damning an admission of weakness; instead he replied, 'I'd like to meet the idiot who put that movie in our library.'

'Katerina probably did it, to test everyone's psychological balance. Anyway, you laughed your head off when we screened it last week.'

Brailovsky was silent; Curnow's remark was perfectly true. But that had been back in the familiar warmth and light of Leonov, among his friends - not in a pitch-black, freezing derelict, haunted by ghosts. No matter how rational one was, it was all too easy to imagine some implacable alien beast prowling these corridors, seeking whom it might devour.

It's all your fault, Grandma (may the Siberian tundra lie lightly on your beloved bones) - I wish you hadn't filled my mind with so many of those gruesome legends. If I close my eyes, I can still see the hut of the Baba Yaga, standing in that forest clearing on its scrawny chicken legs...

Enough of this nonsense. I'm a brilliant young engineer faced with the biggest technical challenge of his life, and I mustn't let my American friend know that I'm sometimes a frightened little boy.

The noises did not help. There were too many of them, though they were so faint that only an experienced astronaut would have detected them against the sounds of his own suit. But to Max Brailovsky, accustomed to working in an environment of utter silence, they were distinctly unnerving, even though he knew that the occasional cracklings and creakings were almost certainly caused by thermal expansion as the ship turned like a roast on a spit. Feeble though the sun was out here, there was still an appreciable temperature change between light and shade.

Even his familiar spacesuit felt wrong, now that there was pressure outside as well as in. All the forces acting on its joints were subtly altered, and he could no longer judge his movements accurately. I'm a beginner, starting my training all over again, he told himself angrily. Time to break the mood by some decisive action.

'Walter - I'd like to test the atmosphere.'

'Pressure's okay; temperature - phew - it's one hundred five below zero.'

'A nice bracing Russian winter. Anyway, the air in my suit will keep out the worst of the cold.'

'Well, go ahead. But let me shine my light on your face, so I can see if you start to turn blue. And keep talking.'

Brailovsky unsealed his visor and swung the faceplate upward. He flinched momentarily as icy fingers seemed to caress his cheeks, then took a cautious sniff, followed by a deeper breath.

'Chilly - but my lungs aren't freezing. There's a funny smell, though. Stale, rotten - as if something's - oh no!'

Looking suddenly pale, Brailovsky quickly snapped the faceplate shut.

'What's the trouble, Max?' Curnow asked with sudden and now perfectly genuine anxiety. Brailovsky did not reply; he looked as if he was still trying

to regain control of himself. Indeed, he seemed in real danger of that always horrible and sometimes fatal disaster - vomiting in a spacesuit.

There was a long silence; then Curnow said reassuringly:

'I get it. But I'm sure you're wrong. We know that Poole was lost in space. Bowman reported that he... ejected the others after they died in hibernation - and we can be sure that he did. There can't be anyone here. Besides, it's so cold.' He almost added 'like a morgue' but checked himself in time.

'But' suppose,' whispered Brailovsky, 'just suppose Bowman managed to get back to the ship - and died here.'

There was an even longer silence before Curnow deliberately and slowly opened his own faceplate. He winced as the freezing air bit into his lungs, then wrinkled his nose in disgust.

'I see what you mean. But you're letting your imagination run away with you. I'll bet you ten to one that smell comes from the galley. Probably some meat went bad, before the ship froze up. And Bowman must have been too busy to be a good housekeeper. I've known bachelor apartments that smelled as bad as this.'

'Maybe you're right. I hope you are.'

'Of course I am. And even if I'm not - dammit, what difference does it make? We've got a job to do, Max. If Dave Bowman's still here, that's not our department - is it, Katerina?'

There was no reply from the Surgeon-Commander; they had gone too far inside the ship for radio to penetrate. They were indeed on their own, but Max's spirits were rapidly reviving. It was a privilege, he decided, to work with Walter. The American engineer sometimes appeared soft and easygoing. But he was totally competent - and, when necessary, as hard as nails.

Together, they would bring Discovery back to life; and, perhaps, back to Earth.

19

Operation WINDMILL

When Discovery suddenly lit up like the proverbial Christmas tree, navigation and interior lights blazing from end to end, the cheer aboard Leonov might almost have been heard across the vacuum between the two ships. It turned into an ironic groan when the lights promptly went out again.

Nothing else happened for half an hour; then the observation windows of Discovery's flight deck began to glow with the soft crimson of the emergency lights. A few minutes later, Curnow and Brailovsky could be seen moving around inside, their figures blurred by the film of sulphur dust.

'Hello, Max - Walter - can you hear us?' called Tanya Orlova. Both the figures waved instantly, but made no other reply. Obviously, they were too busy

to engage in casual conversation; the watchers on Leonov had to wait patiently while various lights flashed on and off, one of the three Pod Bay doors slowly opened and quickly closed, and the main antenna slewed around a modest ten degrees.

'Hello, Leonov,' said Curnow at last. 'Sorry to keep you waiting, but we've been rather busy.

'Here's a quick assessment, judging from what we've seen so far. The ship's in much better shape than I feared. Hull's intact, leakage negligible - air pressure eighty-five per cent nominal. Quite breathable, but we'll have to do a major recycling job because it stinks to high heaven.

'The best news is that the power systems are okay. Main reactor stable, batteries in good shape. Almost all the circuit-breakers were open - they'd jumped or been thrown by Bowman before he left - so all vital equipment's been safeguarded. But it will be a very big job checking everything before we have full power again.'

'How long will that take - at least for the essential systems: life-support, propulsion?'

'Hard to say, skipper. How long before we crash?'

'Minimum present prediction is ten days. But you know how that's changed up - and down.'

'Well, if we don't run into any major snags, we can haul Discovery up to a stable orbit away from this hellhole - oh, I'd say inside a week.'

'Anything you need?'

'No - Max and I are doing fine. We're going into the carousel now, to check the bearings. I want to get it running as soon as possible.'

'Pardon me, Walter - but is that important? Gravity's convenient, but we've managed without any for quite a while.'

'I'm not after gravity, though it will be useful to have some aboard. If we can get the carousel running again, it will mop up the ship's spin - stop it tumbling. Then we'll be able to couple our airlocks together, and cut out EVAs. That will make work a hundred times easier.'

'Nice idea, Walter - but you're not going to mate my ship to that... windmill. Suppose the bearings seize up and the carousel jams? That would tear us to pieces.'

'Agreed. We'll cross that bridge when we come to it. I'll report again as soon as I can.'

No one had much rest for the next two days. By the end of that time, Curnow and Brailovsky had practically fallen asleep in their suits, but had completed their survey of Discovery and found no unpleasant surprises. Both the Space Agency and the State Department were relieved by the preliminary report; it allowed them to claim, with some justification, that Discovery was not a derelict but a 'temporarily decommissioned United States Spacecraft'. Now the task of reconditioning had to begin.

Once power had been restored, the next problem was the air; even the most thorough housecleaning operations had failed to remove the stink. Curnow had been right in identifying its source as food spoiled when refrigeration had failed; he also claimed, with mock seriousness, that it was quite romantic. 'I've only got to close my eyes,' he asserted, 'and I feel I'm back on an old-time whaling ship. Can you imagine what the Pequod must have smelled like?'

It was unanimously agreed that, after a visit to Discovery, very little effort of the imagination was required. The problem was finally solved - or at least reduced to manageable proportions - by dumping the ship's atmosphere. Fortunately, there was still enough air in the reserve tanks to replace it.

One piece of very welcome news was that ninety per cent of the propellant needed for the return journey was still available; choosing ammonia instead of hydrogen as working fluid for the plasma drive had paid off handsomely. The more efficient hydrogen would have boiled off into space years ago, despite the insulation of the tanks and the frigid temperature outside. But almost all the ammonia had remained safely liquified, and there was enough to get the ship back to a safe orbit around the Earth. Or at least around the Moon.

Checking Discovery's propellerlike spin was perhaps the most critical step in getting the ship under control. Sasha Kovalev compared Curnow and Brailovsky to Don Quixote and Sancho Panza, and expressed the hope that their windmill-tilting expedition would end more successfully.

Very cautiously, with many pauses for checking, power was fed to the carousel motors and the great drum was brought up to speed, reabsorbing the spin it had long ago imparted to the ship. Discovery executed a complex series of precessions, until eventually its end-over-end tumble had almost vanished. The last traces of unwanted rotation were neutralized by the attitude-control jets, until the two ships were floating motionless side by side, the squat, stocky Leonov dwarfed by the long, slender Discovery.

Transfer from one to the other was now safe and easy, but Captain Orlova still refused to permit a physical linkup. Everyone agreed with this decision, for Io was coming steadily closer; they might yet have to abandon the vessel they had worked so hard to save.

The fact that they now knew the reason for Discovery's mysterious orbital decay did not help in the least. Every time the ship passed between Jupiter and Io, it sliced through the invisible flux-tube linking the two bodies - the electric river flowing from world to world. The resulting eddy currents induced in the ship were continually slowing it down, braking it once every revolution.

There was no way to predict the final moment of impact, for the current in the flux-tube varied wildly according to Jupiter's own inscrutable laws. Sometimes there were dramatic surges of activity accompanied by spectacular electric and auroral storms around Io. Then the ships would lose altitude by many kilometres, at the same time becoming uncomfortably hot before their thermal control systems could readjust.

This unexpected effect had scared and surprised everyone before the obvious explanation was realized. Any form of braking produces heat, somewhere; the heavy currents induced in the hulls of Leonov and Discovery turned them briefly into low-powered electric furnaces. It was not surprising that some of

Discovery's food supply had been ruined during the years the ship had been alternately cooked and cooled.

The festering landscape of Io, looking more than ever like an illustration from a medical textbook, was only five hundred kilometres away when Curnow risked activating the main drive, while Leonov stood off at a very respectful distance. There were no visible effects - none of the smoke and fire of the old-time chemical rockets - but the two ships drew slowly apart as Discovery gained speed. After a few hours of very gentle manoeuvring, both ships had raised themselves a thousand kilometres; now there was time to relax briefly, and to make plans for the next stage in the mission.

'You've done a wonderful job, Walter,' said Surgeon-Commander Rudenko, putting her ample arm around the exhausted Curnow's shoulders. 'We're all proud of you.'

Very casually, she broke a small capsule under his nose. It was twenty-four hours before he woke up, annoyed and hungry.

20

Guillotine

'What is it?' asked Curnow with mild distaste, hefting the little mechanism in his hand. 'A guillotine for mice?'

'Not a bad description - but I'm after bigger game.' Floyd pointed to a flashing arrow on the display screen, which was now showing a complicated circuit diagram.

'You see this line?'

'Yes - the main power supply. So?'

'This is the point where it enters Hal's central processing unit. I'd like you to install this gadget here. Inside the cable trunking, where it can't be found without a deliberate search.'

'I see. A remote control, so you can pull the plug on Hal whenever you want to. Very neat - and a non-conducting blade, too, so there won't be any embarrassing shorts when it's triggered. Who makes toys like this? The CIA?'

'Never mind. The control's in my room - that little red calculator I always keep on my desk. Put in nine nines, take the square root, and press TNT. That's all. I'm not sure of its range - we'll have to test that - but as long as Leonov and Discovery are within a couple of kilometres of each other, there'll be no danger of Hal running amok again.'

'Who are you going to tell about this... thing?'

'Well, the only person I'm really hiding it from is Chandra.'

'I guessed as much.'

'But the fewer who know, the less likely it is to be talked about. I'll tell Tanya that it exists, and if there's an emergency you can show her how to operate it.'

'What kind of emergency?'

'That's not a very bright question, Walter. If I knew, I wouldn't need the damn thing.'

'Guess you're right. When do you want me to install your patented Hal-zapper?'

'As soon as you can. Preferably tonight. When Chandra's sleeping.'

'Are you kidding? I don't think he ever sleeps. He's like a mother nursing a sick baby.'

'Well, he's got to come back to Leonov to eat, occasionally.'

'I've news for you. The last time he went across, he tied a little sack of rice to his suit. That will keep him going for weeks.'

'Then we'll have to use one of Katerina's famous knockout drops. They did a pretty good job on you, didn't they?'

Curnow was joking about Chandra - at least, Floyd assumed that he was, though one could never be quite sure: he was fond of making outrageous statements with a perfectly straight face. It had been some time before the Russians had fully realized that; soon, in self-defence, they were prone to pre-emptive laughs even when Curnow was being perfectly serious.

Curnow's own laugh, mercifully, had much abated since Floyd had first heard it in the upward-bound shuttle; on that occasion, it had obviously been primed by alcohol. He had fully expected to cringe from it again at the end-of-orbit party, when Leonov had finally made rendezvous with Discovery. But even on that occasion, though Curnow had drunk a good deal, he had remained as much under control as Captain Orlova herself.

The one thing he did take seriously was his work. On the way up from Earth, he had been a passenger. Now he was crew.

21

Resurrection

We are, Floyd told himself, about to awaken a sleeping giant. How will Hal react to our presence, after all these years? What will he remember of the past - and will he be friendly, or hostile?

As he floated just behind Dr Chandra in the zero-gravity environment of Discovery's flight deck, Floyd's mind was seldom far from the cut-off switch, installed and tested only a few hours earlier. The radio control was mere

centimetres from his hand, and he felt somewhat foolish to have brought it with him. At this stage, Hal was still disconnected from all the ship's operational circuits. Even if he was reactivated, he would be a brain without limbs though not without sense organs. He would be able to communicate, but not to act. As Curnow had put it, 'The worst he can do is swear at us.'

'I'm ready for the first test, Captain,' said Chandra. 'All the missing modules have been replaced, and I've run diagnostic programs on all circuits. Everything appears normal, at least on this level.'

Captain Orlova glanced at Floyd, who gave a nod. At Chandra's insistence, only the three of them were present for this critical first run, and it was quite obvious that even this small audience was unwelcome.

'Very well, Dr Chandra.' Ever conscious of protocol, the captain added quickly: 'Dr Floyd has given his approval, and I have no objections myself.'

'I should explain,' said Chandra, in a tone that clearly conveyed disapproval, 'that his voice-recognition and speech-synthesis centres have been damaged. We'll have to teach him to speak all over again. Luckily, he learns several million times faster than a human being.'

The scientist's fingers danced over the keyboard as he typed out a dozen words, apparently at random, carefully pronouncing each one as it appeared on the screen. Like a distorted echo, the words came back from the speaker grille - lifeless, indeed mechanical, with no sense of any intelligence behind them. This isn't the old Hal, thought Floyd. It's no better than the primitive speaking toys that were such a novelty when I was a kid.

Chandra pressed the REPEAT button, and the series of words sounded once again. Already, there was a noticeable improvement, though no one could have mistaken the speaker for a human being.

'The words I gave him contain the basic English phonemes; about ten iterations, and he'll be acceptable. But I don't have the equipment to do a really good job of therapy.'

'Therapy?' asked Floyd. 'You mean that 'he's - well, brain-damaged?'

'No,' snapped Chandra. 'The logic circuits are in perfect condition. Only the voice output may be defective, though it will improve steadily. So check everything against the visual display, to avoid misinterpretations. And when you do speak, enunciate carefully.'

Floyd gave Captain Orlova a wry smile, and asked the obvious question.

'What about all the Russian accents around here?'

'I'm sure that won't be a problem with Captain Orlova and Dr Kovalev. But with the others - well, we'll have to run individual tests. Anyone who can't pass will have to use the keyboard.'

'That's still looking a long way ahead. For the present, you're the only person who should attempt communication. Agreed, Captain?'

'Absolutely.'

Only the briefest of nods revealed that Dr Chandra had heard them. His fingers continued to fly over the keyboard, and columns of words and symbols flashed across the display screen at such a rate that no human being could possibly assimilate them. Presumably Chandra had an eidetic memory, for he appeared to recognize whole pages of information at a glance.

Floyd and Orlova were just about to leave the scientist to his arcane devotions when he suddenly acknowledged their presence again, holding up his hand in warning or anticipation. With an almost hesitant movement, in marked contrast with his previous swift actions, he slid back a locking bar and pressed a single, isolated key.

Instantly, with no perceptible pause, a voice came from the console, no longer in a mechanical parody of human speech. There was intelligence - consciousness - self-awareness here, though as yet only on a rudimentary level.

'Good morning, Dr Chandra, This is Hal. I am ready for my first lesson.'

There was a moment of shocked silence; then, acting on the same impulse, the two observers left the deck.

Heywood Floyd would never have believed it. Dr Chandra was crying.

Iv

LAGRANGE

22

Big Brother

'... What delightful news about the baby dolphin! I can just imagine how excited Chris was when the proud parents brought it into the house. You should have heard the ohs and ahs of my shipmates when they saw the videos of them swimming together, and Chris riding on its back. They suggest we call it Sputnik, which means companion as well as satellite.

'Sorry it's been quite a while since my last message, but the newscasts will have given you an idea of the huge job we've had to do. Even Captain Tanya's given up all pretence of a regular schedule; each problem has to be fixed as it comes along, by whoever is on the spot. We sleep when we can't stay awake any longer.

'I think we can all be proud of what we've done. Both ships are operational and we've nearly finished our first round of tests on Hal. In a couple of days we'll know if we can trust him to fly Discovery when we leave here to make our final rendezvous with Big Brother.

'I don't know who first gave it that name - the Russians, understandably, aren't keen on it. And they've waxed quite sarcastic about our official designation TMA-2, pointing out to me - several times - that it's the best part

of a billion kilometres from Tycho. Also that Bowman reported no magnetic anomaly, and that the only resemblance to TMA-1 is the shape. When I asked them what name they preferred, they came up with Zagadka, which means enigma. It's certainly an excellent name; but everyone smiles when I try to pronounce it, so I'll stick to Big Brother.

'Whatever you call the thing, it's only ten thousand kilometres away now, and the trip won't take more than a few hours. But that last lap has us all nervous, I don't mind telling you.

'We'd hoped that we might find some new information aboard Discovery. That's been our only disappointment, though we should have expected it. Hal, of course, was disconnected long before the encounter, and so has no memories of what happened; Bowman has taken all his secrets with him. There's nothing in the ship's log and automatic recording systems that we didn't already know.

'The only new item we discovered was purely personal - a message that Bowman had left for his mother. I wonder why he never sent it; obviously, he did expect - or hope - to return to the ship after that last EVA. Of course, we've had it forwarded to Mrs Bowman - she's in a nursing home, somewhere in Florida, and her mental condition is poor, so it may not mean anything to her.

'Well, that's all the news this time. I can't tell you how much I miss you... and the blue skies and green seas of Earth. All the colours here are reds and oranges and yellows - often as beautiful as the most fantastic sunset, but after a while one grows sick for the cool, pure rays at the other end of the spectrum.

'My love to you both - I'll call again just as soon as I can.'

23

Rendezvous

Nikolai Temovsky, Leonov's control and cybernetics expert, was the only man aboard who could talk to Dr Chandra on something like his own terms. Although Hal's principal creator and mentor was reluctant to admit anyone into his full confidence, sheer physical exhaustion had forced him to accept help. Russian and Indo-American had formed a temporary alliance, which functioned surprisingly well. Most of the credit for this went to the good-natured Nikolai, who was somehow able to sense when Chandra really needed him, and when he preferred to be alone. The fact that Nikolai's English was much the worst on the ship was totally unimportant, since most of the time both men spoke a computerese wholly unintelligible to anyone else.

After a week's slow and careful reintegration, all of Hal's routine, supervisory functions were operating reliably. He was like a man who could walk, carry out simple orders, do unskilled jobs, and engage in low-level conversation. In human terms, he had an Intelligence Quotient of perhaps 50; only the faintest outlines of his original personality had yet emerged.

He was still sleepwalking; nevertheless, in Chandra's expert opinion, he was now quite capable of flying Discovery from its close orbit around Io up to the rendezvous with Big Brother.

The prospect of getting an extra seven thousand kilometres away from the burning hell beneath them was welcomed by everyone. Trivial though that distance was in astronomical terms, it meant that the sky would no longet be dominated by a landscape that might have been imagined by Dante or Hieronymus Bosch. And although not even the most violent eruptions had blasted any material up to the ships, there was always the fear that Io might attempt to set a new record. As it was, visibility from Leonov's observation deck was steadily degraded by a thin film of sulphur, and sooner or later someone would have to go out and clean it off.

Only Curnow and Chandra were aboard Discovery when Hal was given the first control of the ship. It was a very limited form of control; he was merely repeating the program that had been fed into his memory, and monitoring its execution. And the human crew was monitoring him: if any malfunction occurred, they would take over immediately.

The first burn lasted for ten minutes; then Hal reported that Discovery had entered the transfer orbit. As soon as Leonov's radar and optical tracking confirmed that, the other ship injected itself into the same trajectory. Two minor in-course corrections were made; then, three hours and fifteen minutes later, both arrived uneventfully at the first Lagrange point, L. 1 - 10,500 kilometres up, on the invisible line connecting the centres of Io and Jupiter.

Hal had behaved impeccably, and Chandra showed unmistakable traces of such purely human emotions as satisfaction and even joy. But by that time, everyone's thoughts were elsewhere; Big Brother, alias Zagadka, was only a hundred kilometres away.

Even from that distance, it already appeared larger than the Moon as seen from Earth, and shockingly unnatural in its straight-edged, geometrical perfection. Against the background of space it would have been completely invisible, but the scudding Jovian clouds 350,000 kilometres below showed it up in dramatic relief. They also produced an illusion that, once experienced, the mind found almost impossible to refute. Because there was no way in which its real location could be judged by the eye, Big Brother often looked like a yawning trapdoor set in the face of Jupiter.

There was no reason to suppose that a hundred kilometres would be 'safer than ten, or more dangerous than a thousand; it merely seemed psychologically right for a first reconnaissance. From that distance, the ship's telescopes could have revealed details only centimetres across -but there were none to be seen. Big Brother appeared completely featureless; which, for an object that had, presumably, survived millions of years of bombardment by space debris, was incredible.

When Floyd stared through the binocular eyepiece, it seemed to him that he could reach out and touch those smooth, ebon surfaces - just as he had done on the Moon, years ago. That first time, it had been with the gloved hand of his spacesuit. Not until the Tycho monolith had been enclosed in a pressurized dome had he been able to use his naked hand.

That had made no difference; he did not feel that he had ever really touched TMA-1. The tips of his fingers had seemed to skitter over an invisible barrier,

and the harder he pushed, the greater the repulsion grew. He wondered if Big Brother would produce the same effect.

Yet before they came that close, they had to make every test they could devise and report their observations to Earth. They were in much the same position as explosives experts trying to defuse a new type of bomb, which might be detonated by the slightest false move. For all that they could tell, even the most delicate of radar probes might trigger some unimaginable catastrophe.

For the first twenty-four hours, they did nothing except observe with passive instruments - telescopes, cameras, sensors on every wavelength. Vasili Orlov also took the opportunity of measuring the slab's dimensions with the greatest possible precision, and confirmed the famous 1:4:9 ratio to six decimal places. Big Brother was exactly the same shape as TMA-1 - but as it was more than two kilometres long, it was 718 times larger than its small sibling.

And there was a second mathematical mystery. Men had been arguing for years over that 1:4:9 ratio - the squares of the first three integers. That could not possibly be a coincidence; now here was another number to conjure with.

Back on Earth, statisticians and mathematical physicists were soon playing happily with their computers, trying to relate the ratio to the fundamental constants of nature - the velocity of light, the proton/electron mass ratio, the fine-structure constant. They were quickly joined by a gaggle of numerologists, astrologers, and mystics, who threw in the height of the Great Pyramid, the diameter of Stonehenge, the azimuth bearings of the Nazca lines, the latitude of Easter Island, and a host of other factors from which they were able to draw the most amazing conclusions about the future. They were not in the least deterred when a celebrated Washington humorist claimed that his calculations proved that the world ended on 31 December 1999 - but that everyone had had too much of a hangover to notice.

Nor did Big Brother appear to notice the two ships that had arrived in its vicinity - even when they cautiously probed it with radar beams and bombarded it with strings of radio pulses which, it was hoped, would encourage any intelligent listener to answer in the same fashion.

After two frustrating days, with the approval of Mission Control, the ships halved their distance. From fifty kilometres, the largest face of the slab appeared about four times the width of the Moon in Earth's sky - impressive, but not so large as to be psychologically overwhelming. It could not yet compete with Jupiter, ten times larger still; and already the mood of the expedition was changing from awed alertness to a certain impatience.

Walter Curnow spoke for almost everyone: 'Big Brother may be willing to wait a few million years - we'd like to get away a little sooner.'

24

Reconnaissance

Discovery had left Earth with three of the little space pods that allowed an astronaut to perform extravehicular activities in shirt-sleeve comfort. One had

been lost in the accident - if it was an accident - that had killed Frank Poole. Another had carried Dave Bowman to his final appointment with Big Brother, and shared whatever fate befell him, A third was still in the ship's garage, the Pod Bay.

It lacked one important component - the hatch, blown off by Commander Bowman when he had made his hazardous vacuum-crossing and entered the ship through the emergency airlock, after Hal had refused to open the Pod Bay door. The resulting blast of air had rocketed the pod several hundred kilometres away before Bowman, busy with more important matters, had brought it back under radio control. It was not surprising that he had never bothered to replace the missing hatch.

Now Pod Number 3 (on which Max, refusing all explanations, had stencilled the name Nina) was being prepared for another EVA. It still lacked a hatch, but that was unimportant. No one would be riding inside.

Bowman's devotion to duty was a piece of unexpected luck, and it would have been folly not to take advantage of it. By using Nina as a robot probe, Big Brother could be examined at close quarters without risking human lives. That at least was the theory; no one could rule out the possibility of a backlash that might engulf the ship. After all, fifty kilometres was not even a hair's breadth, as cosmic distances went.

After years of neglect, Nina looked distinctly shabby. The dust that was always floating around in zero gee had settled over the outer surface, so that the once immaculately white hull had become a dingy grey. As it slowly accelerated away from the ship, its external manipulators folded neatly back and its oval viewport staring spaceward like a huge, dead eye, it did not seem a very impressive ambassador of Mankind. But that was a distinct advantage; so humble an emissary might be tolerated, and its small size and low velocity should emphasize its peaceful intentions. There had been a suggestion that it should approach Big Brother with open hands; the idea was quickly turned down when almost everyone agreed that if they saw Nina heading toward them, mechanical claws outstretched, they would run for their lives.

After a leisurely two-hour trip, Nina came to rest a hundred metres from one corner of the huge rectangular slab. From so close at hand, there was no sense of its true shape; the TV cameras might have been looking down on the tip of a black tetrahedron of indefinite size. The onboard instruments showed no sign of radioactivity or magnetic fields; nothing whatsoever was coming from Big Brother except the tiny fraction of sunlight it condescended to reflect.

After five minutes' pause - the equivalent, it was intended, of 'Hello, here I am!' - Nina started a diagonal crossing of the smaller face, then the next larger, and finally the largest, keeping at a distance of about fifty metres, but occasionally coming in to five. Whatever the separation, Big Brother looked exactly the same - smooth and featureless. Long before the mission was completed, it had become boring, and the spectators on both ships had gone back to their various jobs, only glancing at the monitors from time to time.

'That's it,' said Walter Curnow at last, when Nina had arrived back where she had started. 'We could spend the rest of our lives doing this, without learning anything more. What do I do with Nina - bring her home?'

'No,' said Vasili, breaking into the circuit from aboard Leonov. 'I've a suggestion. Take her to the exact centre of the big face. Bring her to rest -

oh, a hundred metres away. And leave her parked there, with the radar switched to maximum precision.'

'No problem - except that there's bound to be some residual drift. But what's the point?'

'I've just remembered an exercise from one of my college astronomy courses - the gravitational attraction of an infinite flat plate. I never thought I'd have a chance of using it in real life. After I've studied Nina's movements for a few hours, at least I'll be able to calculate Zagadka's mass, That is, if it has any. I'm beginning to think there's nothing really there.'

'There's an easy way to settle that, and we'll have to do it eventually. Nina must go in and touch the thing.'

'She already has.'

'What do you mean?' asked Curnow, rather indignantly. 'I never got nearer than five metres.'

'I'm not criticizing your driving skills - though it was a pretty close thing at that first corner, wasn't it? But you've been tapping gently on Zagadka every time you use Nina's thrusters near its surface.'

'A flea jumping on an elephant!'

'Perhaps. We simply don't know. But we'd better assume that, one way or another, it's aware of our presence, and will only tolerate us as long as we aren't a nuisance.'

He left the unspoken question hanging in the air. How did one annoy a two-kilometre-long black rectangular slab? And just what form would its disapproval take?

25

The View from Lagrange

Astronomy was full of such intriguing but meaningless coincidences. The most famous was the fact that, from the Earth, both Sun and Moon have the same apparent diameter. Here at the L.1 libration point, which Big Brother had chosen for its cosmic balancing act on the gravitational tightrope between Jupiter and Io, a similar phenomenon occurred. Planet and satellite appeared exactly the same size.

And what a size! Not the miserable half-degree of Sun and Moon, but forty times their diameter - sixteen hundred times their area. 'The sight of either was enough to fill the mind with awe and wonder; together, the spectacle was overwhelming.

Every forty-two hours, they would go through their complete cycle of phases; when Io was new, Jupiter was full, and vice versa. But even when the Sun was hiding behind Jupiter and the planet presented only its nightside, it was

unmistakably there - a huge black disk eclipsing the stars. Sometimes that blackness would be momentarily rent by lightning flashes lasting for many seconds, from electrical storms far larger than the Earth.

On the opposite side of the sky, always keeping the same face toward its giant master, Io would be a sluggishly boiling cauldron of reds and oranges, with occasional yellow clouds erupting from one of its volcanoes, and falling swiftly back to the surface. Like Jupiter, but on a slightly longer time scale, Io was a world without geography. Its face was remodelled in a matter of decades - Jupiter's, in a matter of days.

As Io waned toward its last quarter, so the vast, intricately banded Jovian cloudscape would light up beneath the tiny, distant sun. Sometimes the shadow of Io itself, or one of the outer satellites, would drift across the face of Jupiter; while every revolution would show the planet-sized vortex of the Great Red Spot - a hurricane that had endured for centuries if not for millennia.

Poised between such wonders, the crew of Leonov had material for lifetimes of research - but the natural objects of the Jovian system were at the very bottom of their list of priorities. Big Brother was Number 1; though the ships had now moved in to only five kilometres, Tanya still refused to allow any direct physical contact. 'I'm going to wait,' she said, 'until we're in a position to make a quick getaway. We'll sit and watch - until our launch window opens. Then we'll consider our next move.'

It was true that Nina had finally grounded on Big Brother, after a leisurely fifty-minute fall. This had allowed Vasili to calculate the object's mass as a surprisingly low 950,000 tons, which gave it about the density of air. Presumably it was hollow - which provoked endless speculation about what might be inside.

But there were plenty of practical, everyday problems to take their minds off these greater issues. Housekeeping chores aboard Leonov and Discovery absorbed ninety per cent of their working time, though operations' were much more efficient since the two ships had been coupled by a flexible docking connection. Curnow had finally convinced Tanya that Discovery's carousel would not suddenly seize up and tear the ships to pieces, so it had become possible to move freely from one vessel to the other merely by opening and closing two sets of airtight doors. Spacesuits and time-consuming EVAs were no longer necessary - to the great delight of everyone except Max, who loved going outside and exercising with his broomstick.

The two crew members quite unaffected by this were Chandra and Ternovsky, who now virtually lived aboard Discovery and worked around the clock, continuing their apparently endless dialogue with Hal. 'When will you be ready?' they were asked at least once a day. They refused to make any promises; Hal remained a low-grade moron.

Then, a week after the rendezvous with Big Brother, Chandra unexpectedly announced: 'We're ready.'

Only the two lady medics were absent from Discovery's flight deck, and that was merely because there was no room for them; they were watching on Leonov's monitors. Floyd stood immediately behind Chandra, his hand never far from what Curnow, with his usual gift for the neat phrase, had called his pocket giant-killer.

'Let me emphasize again,' said Chandra, 'that there must be no talking. Your accents will confuse him; I can speak, but no one else. Is that understood?'

Chandra looked, and sounded, at the edge of exhaustion. Yet his voice held a note of authority that no one had ever heard before. Tanya might be the boss everywhere else, but he was master there.

The audience - some anchored to convenient handholds, some floating freely - nodded assent. Chandra closed an audio switch and said, quietly but clearly: 'Good morning, Hal.'

An instant later, it seemed to Floyd that the years had rolled away. It was no longer a simple electronic toy that answered back. Hal had returned.

'Good morning, Dr Chandra.'

'Do you feel capable of resuming your duties?'

'Of course. I am completely operational and all my circuits are functioning perfectly.'

'Then do you mind if I ask you a few questions?'

'Not at all.'

'Do you recall a failure of the AE 35 antenna control unit?'

'Certainly not.'

Despite Chandra's injunction, there was a little gasp from the listeners. This is like tiptoeing through a minefield, thought Floyd, as he patted the reassuring shape of the radio cut-off. If that line of questioning triggered another psychosis, he could kill Hal in a second. (He knew, having rehearsed the procedure a dozen times.) But a second was aeons to a computer; that was a chance they would have to take.

'You do not remember either Dave Bowman or Frank Poole going out to replace the AE 35 unit?'

'No. That could not have happened, or I would have remembered it. Where are Frank and Dave? Who are these people? I can only identify you - though I compute a sixty-five per cent probability that the man behind you is Dr Heywood Floyd.'

Remembering Chandra's strict injunction, Floyd refrained from congratulating Hal. After a decade, sixty-five per cent was a pretty good score. Many humans would not have done so well.

'Don't worry, Hal - I will explain everything later.'

'Has the mission been completed? You know I have the greatest enthusiasm for it.'

'The mission has been completed; you have carried out your program. Now - if you will excuse us - we wish to have a private conversation.'

'Certainly.'

Chandra switched off sound and vision inputs to the main console. As far as this part of the ship was concerned, Hal was now deaf and blind.

'Well, what was all that about?' demanded Vasili Orlov.

'It means,' said Chandra, carefully and precisely, 'that I have erased all Hal's memories, beginning at the moment when the trouble started.'

'That sounds quite a feat,' marvelled Sasha. 'How did you do it?'

'I am afraid it would take me longer to explain than it did to carry out the operation.'

'Chandra, I am a computer expert - though not in the same class as you and Nikolai. The 9000 series uses holographic memories, doesn't it? So you couldn't have used a simple chronological erasure. It must have been some kind of tapeworm, homing on selected words and concepts?'

'Tapeworm?' said Katerina over the ship's intercom. 'I thought that was my department - though I'm glad to say I've never seen one of the beastly things outside a jar of alcohol. What are you talking about?'

'Computer jargon, Katerina. In the old days - the very old days - they really did use magnetic tape. And it's possible to construct a program that can be fed into a system to hunt down and destroy - eat, if you like - any desired memories. 'Can't you do the same sort of thing to human beings, by hypnosis?'

'Yes, but it can always be reversed. We never really forget anything. We only think we do.'

'A computer doesn't work that way. When it's told to forget something, it does. The information is completely erased.'

'So Hal has absolutely no memory of his... misbehaviour?'

'I cannot be a hundred per cent certain of that,' answered Chandra. 'There may be some memories that were in transit from one address to another when the... tapeworm was making its search. But this is very unlikely.'

'Fascinating,' said Tanya, after everyone had thought this over in silence for some time. 'But the much more important question is: Can he be relied upon in future?'

Before Chandra could answer, Floyd anticipated him.

'The same set of circumstances can never arise again; I can promise you that. The whole trouble started because it's difficult to explain Security to a computer.'

'Or to human beings,' muttered Curnow, not very sotto voce.

'I hope you're right,' said Tanya, without much conviction. 'What's the next step, Chandra?'

'Nothing so tricky - merely long and tedious. Now we have to program him to initiate the Jupiter escape sequence - and to bring Discovery home. Three years after we've got back on our high-speed orbit.'

26

Probation

To: Victor Millson, Chairman, National Council on Astronautics, Washington

From: Heywood Floyd, aboard USSC Discovery

Subject: Malfunction of onboard computer HAL 9000

Classification: SECRET

Dr Chandrasegarampillai (hereinafter referred to as Dr C.) has now completed his preliminary examination of Hal. He has restored all missing modules and the computer appears to be fully operational. Details of Dr C.'s actions and conclusions will be found in the report he and Dr Ternovsky will submit shortly.

Meanwhile you have asked me to summarize them in non-technical terms for the benefit of the Council - especially the new members who will not be familiar with the background. Frankly, I doubt my ability to do this; as you know, I am not a computer specialist. But I will do my best.

The problem was apparently caused by a conflict between Hal's basic instructions and the requirements of Security. By direct Presidential order, the existence of TMA-1 was kept a complete secret. Only those with a need to know were permitted access to the information.

Discovery's mission to Jupiter was already in the advanced planning stage when TMA-1 was excavated, and radiated its signal to that planet. As the function of the prime crew (Bowman. Poole) was merely to get the vessel to its destination, it was decided that they should not be informed of its new objective. By training the investigative team (Kaminski, Hunter, Whitehead) separately, and placing them in hibernation before the voyage began, it was felt that a much higher degree of security would be attained, as the danger of leaks (accidental or otherwise) would be greatly reduced.

I would like to remind you that, at the time (my memorandum NCA 342/23/TOP SECRET of 01.04.03) I pointed out several objections to this policy. However, they were overruled at a higher level.

As Hal was capable of operating the ship without human assistance, it was also decided that he should be programmed to carry out the mission autonomously in the event of the crew's being incapacitated or killed. He was therefore given full knowledge of its objectives, but was not permitted to reveal them to Bowman or Poole.

This situation conflicted with the purpose for which Hal had been designed - the accurate processing of information without distortion or concealment. As a result, Hal developed what would be called, in human terms, a psychosis - specifically, schizophrenia. Dr C. informs me that, in technical terminology,

Hal became trapped in a Hofstadter-Moebius loop, a situation apparently not uncommon among advanced computers with autonomous goal-seeking programs. He suggests that for further information you contact Professor Hofstadter himself.

To put it crudely (if I understand Dr C.) Hal was faced with an intolerable dilemma, and so developed paranoiac symptoms that were directed against those monitoring his performance back on Earth. He accordingly attempted to break the radio link with Mission Control, first by reporting a (non-existent) fault in the AE 35 antenna unit.

This involved him not only in a direct lie - which must have aggravated his psychosis still further - but also in a confrontation with the crew. Presumably (we can only guess at this, of course) he decided that the only way out of the situation was to eliminate his human colleagues - which he very nearly succeeded in doing. Looking at the matter purely objectively, it would have been interesting to see what would have happened had he continued the mission alone, without man-made 'interference'.

This is virtually all I have been able to learn from Dr C.; I do not like to question him further, as he is working to the point of exhaustion. But even allowing for this fact, I must frankly state (and please keep this absolutely confidential) that Dr C. is not always as cooperative as he should be. He adopts a defensive attitude toward Hal, which sometimes makes it extremely difficult to discuss the subject. Even Dr Ternovsky, who might have been expected to be a little more independent, often appears to share this viewpoint.

However, the only really important question is: Can Hal be relied upon in the future? Dr C., of course, has no doubts on the matter. He claims to have obliterated all the computer's memories of the traumatic events leading up to the disconnection. Nor does he believe that Hal can suffer from anything remotely analogous to the human sense of guilt.

In any case, it seems impossible that the situation that caused the original problem can ever arise again. Although Hal suffers from a number of peculiarities, they are not of a nature that would cause any apprehension; they are merely minor annoyances, some of them even amusing. And as you know - but Dr C. does not - I have taken steps that will give us complete control as a last resort.

To sum up: The rehabilitation of HAL 9000 is proceeding satisfactorily. One might even say that he is on probation.

I wonder if he knows it.

27

Interlude: True Confessions

The human mind has an astonishing capacity to adapt; after a while, even the incredible becomes commonplace. There were times when the crew of Leonov switched off their surroundings, perhaps in an unconscious move to preserve sanity.

Dr Heywood Floyd often thought that, on such occasions, Walter Curnow worked a little too hard at being the life and soul of the party. And though he triggered what Sasha Kovalev later called the 'True Confessions' episode, he certainly had not planned anything of the sort. It arose spontaneously when he voiced the universal dissatisfaction with almost all aspects of zero-gravity plumbing.

'If I could have one wish granted,' he exclaimed during the daily Six O'Clock Soviet, 'it would be to soak in a nice foaming bathtub, scented with essence of pine and with just my nose above the waterline.'

When the murmurs of assent and sighs of frustrated desire had died away, Katerina Rudenko took up the challenge.

'How splendidly decadent, Walter,' she beamed at him with cheerful disapproval. 'It makes you sound like a Roman emperor. If I were back on Earth, I'd like something more active.'

'Such as?'

'Umm... Am I allowed to go back in time as well?'

'If you like.'

'When I was a girl, I used to go for holidays to a collective farm in Georgia. There was a beautiful palomino stallion, bought by the director out of the money he'd made on the local black market. He was an old scoundrel, but I loved him - and he used to let me gallop Alexander all over the countryside. I might have been killed - but that's the memory that brings Earth back to me, more than anything else.'

There was a moment of thoughtful silence; then Curnow asked, 'Any other volunteers?'

Everyone seemed so lost in their own memories that the game might have ended there, had not Maxim Brailovsky started it off again.

'I'd like to be diving - that was just about my favourite hobby, when I had time for one - and I was glad I could keep it up through my cosmonaut training. I've dived off Pacific atolls, the Great Barrier Reef, the Red Sea - coral reefs are the most beautiful places in the world. Yet the experience I remember best was in quite a different place - one of the Japanese kelp forests. It was like an underwater cathedral, with sunlight slanting through those enormous leaves. Mysterious... magical. I've never been back; perhaps it wouldn't be the same the next time. But I'd like to try.'

'Fine,' said Walter, who as usual had appointed himself master of ceremonies. 'Who's next?'

'I'll give you a quick answer,' said Tanya Orlova. 'The Bolshoi - Swan Lake. But Vasili won't agree. He hates ballet.'

'That makes two of us. Anyway, what would you select, Vasili?'

'I was going to say diving, but Max beat me to it. So I'll go in the opposite direction - gliding. Soaring through the clouds on a summer day, in complete silence. Well, not quite complete - the airflow over the wing can get

noisy, especially when you're banking. That's the way to enjoy Earth- like a bird.'

'Zenia?'

'Easy. Skiing in the Pamirs. I love snow.'

'And you, Chandra?'

The atmosphere changed noticeably when Walter put the question. After all this time, Chandra was still a stranger - perfectly polite, even courteous, but never revealing himself.

'When I was a boy,' he said slowly, 'my grandfather took me on a pilgrimage to Varanasi - Benares. If you've never been there, I'm afraid you won't understand. To me - to many Indians even nowadays, whatever their religion - it's the centre of the world. One day I plan to go back.'

'And you, Nikolai?'

'Well, we've had the sea and sky. I'd like to combine both. My favourite sport used to be wind-surfing. I'm afraid I'm too old for it now - but I'd like to find out.'

'That only leaves you, Woody. What's your choice?'

Floyd did not even stop to think; his spontaneous answer surprised himself as much as the others.

'I don't mind where on Earth I am - as long as I'm with my little son.'

After that, there was no more to be said. The session was over.

28

Frustration

'You've seen all the technical reports, Dimitri, so you'll understand our frustration. We've learned nothing new from all our tests and measurements. Zagadka just sits there, filling half the sky, ignoring us completely.

'Yet it can't be inert - an abandoned space derelict. Vasili has pointed out that it must be taking some positive action, to remain here at the unstable libration point. Otherwise it would have drifted away ages ago, just as Discovery did, and crashed into Io.

'So what do we do next? We wouldn't have nuclear explosives on board, would we, in contravention of UN '08, para 3? I'm only joking.

'Now that we're under less pressure, and the launch window for the homeward trip is still weeks away, there's a distinct feeling of boredom, as well as frustration. Don't laugh - I can imagine how that sounds to you, back in Moscow.

How could any intelligent person get bored out here, surrounded by the greatest marvels human eyes have ever seen?

'Yet there's no doubt of it. Morale isn't what it was. Until now, we've all been disgustingly healthy. Now almost everyone has a minor cold, or an upset stomach, or a scratch that won't heal despite all of Katerina's pills and powders. She's given up now, and just swears at us.

'Sasha has helped to keep us amused with a series of bulletins on the ship's bulletin board. Their theme is: STAMP OUT RUSSLISH! and he lists horrid mixtures of both languages he claims to have overheard, wrong uses of words, and so forth. We'll all need linguistic decontamination when we get home; several times I've come across your countrymen chatting in English without even being aware of it, lapsing into their native tongue only for difficult words. The other day I caught myself talking Russian to Walter Curnow - and neither of us noticed for several minutes.

'There was one bit of unscheduled activity the other day that will tell you something about our state of mind. The fire alarm went off in the middle of the night, triggered by one of the smoke detectors.

'Well, it turned out that Chandra had smuggled some of his lethal cigars aboard, and couldn't resist temptation anymore. He was smoking one in the toilet, like a guilty schoolboy.

'Of course, he was horribly embarrassed; everyone else thought it hysterically funny, after the initial panic. You know the way some perfectly trivial joke, which doesn't mean a thing to outsiders, can sweep through a group of otherwise intelligent people and reduce them to helpless laughter. One had only to pretend to light a cigar for the next few days, and everybody would go to pieces.

'What makes it even more ridiculous is that no one would have minded in the least if Chandra had just gone into an airlock, or switched off the smoke detector. But he was too shy to admit that he had such a human weakness; so now he spends even more of his time communing with Hal.'

Floyd pressed the PAUSE button and stopped the recording. Perhaps it was not fair to make fun of Chandra, tempting though it often was. All sorts of little quirks of personality had surfaced during the last few weeks; there had even been some bad quarrels, for no obvious reason. And for that matter, what of his own behaviour? Had that always been above criticism?

He was still not sure if he had handled Curnow properly. Though he did not suppose that he would ever really like the big engineer, or enjoy the sound of his slightly too-loud voice, Floyd's attitude toward him had changed from mere tolerance to respectful admiration. The Russians adored him, not least because his rendering of such favourites as 'Polyushko Polye' often reduced them to tears. And in one case, Floyd felt that the adoration had gone a little too far.

'Walter,' he had begun cautiously, 'I'm not sure if it's my business, but there's a personal matter I'd like to raise with you...'

'When someone says it's not his business, he's usually right. What's the problem?'

'To be blunt, your behaviour with Max.'

There was a frigid silence, which Floyd occupied with a careful inspection of the poor paintjob on the opposite wall. Then Curnow replied, in a soft yet implacable voice: 'I was under the distinct impression that he was more than eighteen.'

'Don't confuse the issue. And frankly, it's not Max I'm concerned about. It's Zenia.'

Curnow's lips parted in unconcealed surprise. 'Zenia? What's she got to do with it?'

'For an intelligent man, you're often singularly unobservant - even obtuse. Surely you realize that she's in love with Max. Haven't you noticed the way she looks, when you put your arm around him?'

Floyd had never imagined that he would see Curnow looking abashed, but the blow seemed to have struck home.

'Zenia? I thought everyone was joking - she's such a quiet little mouse. And everyone's in love with Max, after their fashion - even Catherine the Great. Still... um, I guess I should be more careful. At least while Zenia's around.'

There was a prolonged silence while the social temperature rose back to normal. Then, obviously to show that there was no ill feeling, Curnow added in a conversational tone: 'You know, I've often wondered about Zenia, Somebody did a marvellous job of plastic surgery on her face, but they couldn't repair all the damage. The skin's too tight, and I don't think I've ever seen her laugh properly. Maybe that's why I've avoided looking at her - would you credit me with so much aesthetic sensitivity, Heywood?'

The deliberately formal 'Heywood' signalled good-natured needling rather than hostility, and Floyd allowed himself to relax.

'I can satisfy some of your curiosity - Washington finally got hold of the facts. It seems she was in a bad air crash and was lucky to recover from her burns. There's no mystery, as far as we can tell, but Aeroflot isn't supposed to have accidents.'

'Poor girl. I'm surprised they let her go into space, but I suppose she was the only qualified person available when Irma eliminated herself. I'm sorry for her; apart from the injuries, the psychological shock must have been terrible.'

'I'm sure it was; but she's obviously made a full recovery.' You're not telling the whole truth, said Floyd to himself, and you never will. After their encounter on the approach to Jupiter, there would always be a secret bond between them - not of love, but of tenderness, which is often more enduring.

He found himself suddenly and unexpectedly grateful to Curnow; the other was obviously surprised at his concern for Zenia, but had not attempted to exploit it in his own defence.

And if he had, would it have been unfair? Now, days later, Floyd was beginning to wonder if his own motives were altogether admirable. For his part, Curnow had certainly kept his promise; indeed, if one did not know better, one might have imagined that he was deliberately ignoring Max - at least while Zenia

was around. And he treated her with much greater kindness; indeed, there were occasions when he had even succeeded in making her laugh out loud.

So the intervention had been worthwhile, whatever the impulse behind it. Even if, as Floyd sometimes ruefully suspected, it was no more than the secret envy that normal homo or heterosexuals feel, if completely honest with themselves, toward cheerfully well-adjusted polymorphs.

His finger crept back toward the recorder, but the train of thought had been broken. Inevitably, images of his own home and family came crowding into his mind, He closed his eyes, and memory recalled the climax of Christopher's birthday party - the child blowing out the three candles on the cake, less than twenty-four hours ago but almost a billion kilometres away. He had played the video back so often that now he knew the scene by heart.

And how often had Caroline played his messages to Chris, so that the boy would not forget his father - or view him as a stranger when he returned after missing yet another birthday? He was almost afraid to ask.

Yet he could not blame Caroline. To him, only a few weeks would have passed before they met again. But she would have aged more than two years while he was in his dreamless sleep between the worlds. That was a long time to be a young widow, even a temporary one.

I wonder if I'm coming down with one of the shipboard maladies, Floyd thought; he had seldom felt such a sense of frustration, even of failure. I may have lost my family, across the gulfs of time and space, all to no purpose. For I have achieved nothing; even though I have reached my goal, it remains a blank, impenetrable wall of total darkness.

And yet - David Bowman had once cried: 'My God! It's full of stars!'

29

Emergence

Sasha's latest edict read:

RUSSLISH BULLETIN #8

Subject: Tovanshch (tovarish)

To our American guests:

Frankly, pals, I can't remember when I was last addressed by this term. To any twenty-first century Russian, it's way back there with the battleship

Potemkin - a reminder of cloth caps and red flags and Vladimir Ilich haranguing the workers from the steps of railway carriages

Ever since I was a kid it's been bratets or druzhok- take your choice, you're welcome.

Comrade Kovalev

Floyd was still chuckling over this notice when Vasili Orlov joined him as he floated through the lounge/observation deck on his way to the bridge.

'What amazes me, tovarishch, is that Sasha ever found time to study anything besides engineering physics. Yet he's always quoting poems and plays I don't even know, and he speaks better English than - well, Walter.'

'Because he switched to science, Sasha is - what do you say - the black sheep of the family. His father was a professor of English at Novosibirsk. Russian was only allowed in the house Monday to Wednesday; Thursday to Saturday it was English.'

'And Sundays?'

'Oh, French or German, alternate weeks.'

'Now I know exactly what you mean by nekulturny; fits me like a glove. Does Sasha feel guilty about his... defection? And with such a background, why did he ever become an engineer?'

'At Novosibirsk, you soon learn who are the serfs and who are the aristocrats. Sasha was an ambitious young man, as well as a brilliant one.'

'Just like you, Vasili.'

'Et tu, Brute! You see, I can quote Shakespeare as well - Bozhe moi! - what was that?'

Floyd was unlucky; he was floating with his back to the observation window, and saw nothing at all. When he twisted around, seconds later, there was only the familiar view of Big Brother, bisecting the giant disk of Jupiter, just as it had done ever since their arrival.

But to Vasili, for a moment that would be imprinted on his memory forever, that sharp-edged outline held a completely different, and wholly impossible, scene. It was as if a window had suddenly been opened onto another universe.

The vision lasted for less than a second, before his involuntary blink reflex cut it off. He was looking into a field not of stars, but of suns, as if into the crowded heart of a galaxy, or the core of a globular cluster. In that moment, Vasili Orlov lost forever the skies of Earth. From now on they would seem intolerably empty; even mighty Orion and glorious Scorpio would be scarcely noticeable patterns of feeble sparks, not worthy of a second glance.

When he dared to open his eyes again, it was all gone. No - not completely. At the very centre of the now-restored ebon rectangle, a faint star was still shining.

But a star did not move as one watched. Orlov blinked again, to clear his watering eyes. Yes, the movement was real; he was not imagining it.

A meteor? It was some indication of Chief Scientist Vasili Orlov's state of shock that several seconds passed before he remembered that meteors were impossible in airless space.

Then it blurred suddenly into a streak of light, and within a few heartbeats had vanished beyond the edge of Jupiter. By this time, Vasili had recovered his wits and was once more the cool, dispassionate observer.

Already he had a good estimate of the object's trajectory. There could be no doubt; it was aimed directly at Earth.

V

A CHILD OF THE STARS

30

Homecoming

It was as if he had awakened from a dream - or a dream within a dream. The gate between the stars had brought him back to the world of men, but no longer as a man.

How long had he been away? A whole lifetime... no, two lifetimes; one forward, one in reverse.

As David Bowman, commander and last surviving crew member of United States Spaceship Discovery, he had been caught in a gigantic trap, set three million years ago and triggered to respond only at the right time, and to the right stimulus. He had fallen through it, from one universe to another, meeting wonders some of which he now understood, others which he might never comprehend.

He had raced at ever-accelerating speed, down infinite corridors of light, until he had outraced light itself. That, he knew, was impossible; but now he also knew how it could be done. As Einstein had rightly said, the Good Lord was subtle, but never malicious.

He had passed through a cosmic switching system - a Grand Central Station of the galaxies - and emerged, protected from its fury by unknown forces, close to the surface of a giant red star.

There he had witnessed the paradox of sunrise on the face of a sun, when the dying star's brilliant white dwarf companion had climbed into its sky - a searing apparition, drawing a tidal wave of fire beneath it. He had felt no fear, but only wonder, even when his space pod had carried him down into the inferno below... to arrive, beyond all reason, in a beautifully appointed hotel suite containing nothing that was not wholly familiar. However, much of it was

fake; the books on the shelves were dummies, the cereal boxes and the cans of beer in the icebox - though they bore famous labels - all contained the same bland food with a texture like bread but a taste that was almost anything he cared to imagine.

He had quickly realized that he was a specimen in a cosmic zoo, his cage carefully recreated from the images in old television programmes. And he wondered when his keepers would appear, and in what physical form.

How foolish that expectation had been! He knew now that one might as well hope to see the wind, or speculate about the true shape of fire.

Then exhaustion of mind and body had overwhelmed him. For the last time, David Bowman slept.

It was a strange sleep, for he was not wholly unconscious. Like a fog creeping through a forest, something invaded his mind. He sensed it only dimly, for the full impact would have destroyed him as swiftly and surely as the fires raging around him. Beneath its dispassionate scrutiny, he felt neither hope nor fear.

Sometimes, in that long sleep, he dreamed he was awake. Years had gone by; once he was looking in a mirror, at a wrinkled face he barely recognized as his own. His body was racing to its dissolution, the hands of the biological clock spinning madly toward a midnight they would never reach. For at the last moment, Time came to a halt - and reversed itself.

The springs of memory were being trapped: in controlled recollection, he was reliving his past, being drained of knowledge and experience as he swept back toward his childhood. But nothing was being lost: all that he had ever been, at every moment of his life, was being transferred to safer keeping. Even as one David Bowman ceased to exist, another became immortal, passing beyond the necessities of matter.

He was an embryo god, not yet ready to be born. For ages he floated in limbo, knowing what he had been, but not what he had become. He was still in a state of flux -somewhere between chrysalis and butterfly. Or perhaps only between caterpillar and chrysalis.

And then, the stasis was broken: Time re-entered his little world. The black, rectangular slab that suddenly appeared before him was like an old friend.

He had seen it on the Moon; he had encountered it in orbit around Jupiter; and he knew, somehow, that his ancestors had met it long ago. Though it held still unfathomed secrets, it was no longer a total mystery; some of its powers he now understood.

He realized that it was not one, but multitudes; and that whatever measuring instruments might say, it was always the same size - as large as necessary.

How obvious, now, was that mathematical ratio of its sides, the quadratic sequence 1:4:9! And how naive to have imagined that the series ended there, in only three dimensions!

Even as his mind focused upon these geometrical simplicities, the empty rectangle filled with stars. The hotel suite - if indeed it had ever really

existed - dissolved back into the mind of its creator; and there before him was the luminous whirlpool of the Galaxy.

It might have been some beautiful, incredibly detailed model, embedded in a block of plastic. But it was the reality, now grasped by him as a whole with senses more subtle than vision. If he wished, he could focus his attention upon any one of its hundred billion stars.

Here he was, adrift in this great river of suns, halfway between the banked fires of the galactic core and the lonely, scattered sentinel stars of the rim. And there was his origin, on the far side of this chasm in the sky, this serpentine band of darkness, empty of all stars. He knew that this formless chaos, visible only by the glow that limned its edges from fire mists far beyond, was the still unused stuff of creation, the raw material of evolutions yet to be. Here, Time had not yet begun; not until the suns that now burned were long since dead would light and life reshape this void.

Unwittingly, he had crossed it once: now, far better prepared, though still wholly ignorant of the impulse that drove him, he must cross it again.

The Galaxy burst forth from the mental frame in which he had enclosed it: stars and nebulae poured past him in an illusion of infinite speed. Phantom suns exploded and fell behind as he slipped like a shadow through their cores.

The stars were thinning out, the glare of the Milky Way dimming into a pale ghost of the glory he had known - and might one day know again. He was back in the space that men called real, at the very point he had left it, seconds or centuries ago.

He was vividly aware of his surroundings, and far more conscious than in that earlier existence of myriad sensory inputs from the external world. He could focus upon any one of them, and scrutinize it in virtually limitless detail, until he confronted the fundamental, granular structure of time and space, below which there was only chaos.

And he could move, though he did not know how. But had he ever really known that, even when he possessed a body? The chain of command from brain to limb was a mystery to which he had never given any thought.

An effort of will, and the spectrum of that nearby star shifted toward the blue, by precisely the amount he wished. He was falling toward it at a large fraction of the speed of light: though he could go faster if he desired, he was in no hurry. There was still much information to be processed, much to be considered... and much more to be won. That, he knew, was his present goal; but he also knew that it was only part of some far wider plan, to be revealed in due course.

He gave no thought to the gateway between universes dwindling so swiftly behind him, or to the anxious entities gathered around it in their primitive spacecraft. They were part of his memories; but stronger ones were calling him now, calling him home to the world he had never thought to see again.

He could hear its myriad voices, growing louder and louder - as it too was growing, from a star almost lost against the Sun's outstretched corona, to a slim crescent, and finally to a glorious blue-white disk.

They knew that he was coming. Down there on that crowded globe, the alarms would be flashing across the radar screens, the great tracking telescopes would be searching the skies - and history as men had known it would be drawing to a close.

He became aware that a thousand kilometres below a slumbering cargo of death had awakened, and was stirring in its orbit. The feeble energies it contained were no possible menace to him; indeed, he could profitably use them.

He entered the maze of circuitry, and swiftly traced the way to its lethal core. Most of the branchings could be ignored; they were blind alleys, devised for protection. Beneath his scrutiny, their purpose was childishly simple; it was easy to bypass them all.

Now there was a single last barrier - a crude but effective mechanical relay, holding apart two contacts. Until they were closed, there would be no power to activate the final sequence.

He put forth his will - and, for the first time, knew failure and frustration. The few grams of the microswitch would not budge. He was still a creature of pure energy; as yet, the world of inert matter was beyond his grasp. Well, there was a simple answer to that.

He still had much to learn. The current pulse he induced in the relay was so powerful that it almost melted the coil, before it could operate the trigger mechanism.

The microseconds ticked slowly by. It was interesting to observe the explosive lenses focus their energies, like the feeble match that ignites a powder train, which in turn -

The megatons flowered in a silent detonation that brought a brief, false dawn to half the sleeping world. Like a phoenix rising from the flames, he absorbed what he needed, and discarded the rest. Far below, the shield of the atmosphere, which protected the planet from so many hazards, absorbed the most dangerous of the radiation. But there would be some unlucky men and animals who would never see again.

In the aftermath of the explosion, it seemed as if the Earth was struck dumb. The babble of the short and medium waves was completely silenced, reflected back by the suddenly enhanced ionosphere. Only the microwaves still sliced through the invisible and slowly dissolving mirror that now surrounded the planet, and most of these were too tightly beamed for him to receive them. A few high-powered radars were still focused upon him, but that was a matter of no importance. He did not even bother to neutralize them as he could easily have done. And if any more bombs were to come his way, he would treat them with equal indifference. For the present, he had all the energy he needed.

And now he was descending, in great sweeping spirals, toward the lost landscape of his childhood.

31

Disneyville

A fin-de-siecle philosopher had once remarked - and been roundly denounced for his pains - that Walter Elias Disney had contributed more to genuine human happiness than all the religious teachers in history. Now, half a century after the artist's death, his dreams were still proliferating across the Florida landscape.

When it had opened in the early 1980s, his Experimental Prototype Community of Tomorrow had been a showcase for new technologies and modes of living. But as its founder had realized, EPCOT would only fulfil its purpose when some of its vast acreage was a genuine, living town, occupied by people who called it home. That process had taken the remainder of the century; now the residential area had twenty thousand inhabitants and had, inevitably, become popularly known as Disneyville.

Because they could move in only after penetrating a palace guard of WED lawyers, it was not surprising that the average age of the occupants was the highest in any United States community, or that its medical services were the most advanced in the world. Some of them, indeed, could hardly have been conceived, still less created, in any other place.

The apartment had been carefully designed not to look like a hospital suite, and only a few unusual fittings would have betrayed its purpose. The bed was scarcely knee-high, so that the danger of falls was minimized: it could, however, be raised and tilted for the convenience of the nurses. The bathroom tub was sunk into the floor, and had a built-in seat as well as handrails, so that even the elderly or infirm could get in and out of it easily. The floor was thickly carpeted, but there were no rugs over which one could trip, or sharp corners that might cause injuries. Other details were less obvious - and the TV camera was so well concealed that no one would have suspected its presence.

There were few personal touches - a pile of old books in one corner, and a framed front page of one of the last printed issues of the New York Times proclaiming: US SPACESHIP LEAVES FOR JUPITER. Close to this were two photographs, one showing a boy in his late teens; the other, a considerably older man wearing astronaut's uniform.

Though the frail, grey-haired woman watching the domestic comedy unfolding on the TV panel was not yet seventy, she looked much older. From time to time she chuckled appreciatively at some joke from the screen, but she kept glancing at the door as if expecting a visitor. And when she did so, she took a firmer grasp on the walking stick propped against her chair.

Yet she was distracted by a moment of TV drama when the door finally opened, and she looked around with a guilty start as the little service trolley rolled into the room, followed closely by a uniformed nurse.

'Time for lunch, Jessie,' called the nurse: 'We've got something very nice for you today.'

'Don't want any lunch.'

'It will make you feel a lot better.'

'I won't eat until you tell me what it is.'

'Why won't you eat it?'

'I'm not hungry. Are you ever hungry?' she added slyly.

The robot food trolley came to a halt beside the chair, and the transport covers opened up to reveal the dishes. Throughout, the nurse never touched anything, not even the controls on the trolley. She now stood motionless, with a rather fixed smile, looking at her difficult patient.

In the monitor room fifty metres away, the medical technician said to the doctor: 'Now watch this.'

Jessie's gnarled hand lifted the walking stick; then, with surprising speed, she swept it in a short arc toward the nurse's legs.

The nurse took no notice whatsoever, even when the stick sliced right through her. Instead, she remarked soothingly, 'Now, doesn't that look nice? Eat it up, dear.'

A cunning smile spread across Jessie's face, but she obeyed instructions. In a moment, she was eating heartily.

'You see?' said the technician. 'She knows perfectly well what's going on. She's a lot brighter than she pretends to be, most of the time.'

'And she's the first?'

'Yes. All the others believe that really is Nurse Williams, bringing their meals.'

'Well, I don't think it matters. Look how pleased she is, just because she's outsmarted us. She's eating her food, which is the purpose of the exercise. But we must warn the nurses - all of them, not just Williams.'

'Why - oh, of course. The next time it may not be a hologram - and then think of the lawsuits we'll be facing from our battered staff.'

32

Crystal Spring

The Indians, and the Cajun settlers who had moved here from Louisiana, said that Crystal Spring was bottomless. That, of course, was nonsense, and surely even they could not believe it. One had only to put on a face mask and swim out a few strokes - and there, clearly visible, was the little cave from which the incredibly pure water flowed with the slender green weeds undulating around it. And peering up through them, the eyes of the Monster.

Two dark circles, side by side - even though they never moved, what else could they be? That lurking presence gave an added excitement to every swim; one day the Monster would come rushing up from its lair, scattering the fish in its

hunt for larger prey. Never would Bobby or David admit that nothing more dangerous than an abandoned, and doubtless stolen, bicycle lay half buried among the water weeds, a hundred metres down.

That depth was hard to believe, even after line and sinker had established it beyond argument. Bobby, the older and better diver, had been perhaps a tenth of the way down, and had reported that the bottom looked just as far away as ever.

But now the Crystal Spring was about to reveal its secrets; perhaps the legend of the Confederate treasure was true, despite the scorn of all the local historians. At the very least, they might endear themselves to the chief of police - always excellent policy - by recovering a few handguns deposited after recent crimes.

The little air compressor that Bobby had found in the garage junk heap was now chugging healthily away, after their initial problems of starting it. Every few seconds it would cough and emit a cloud of blue smoke, but it showed no sign of stopping. 'And even if it does,' said Bobby, 'so what? If the girls in the Underwater Theatre can swim up from fifty metres without their air hoses, so can we. It's perfectly safe.'

In that case, thought Dave fleetingly, why didn't we tell Ma what we were doing, and why did we wait until Dad had gone back to the Cape for the next shuttle launch? But he did not have any real qualms: Bobby always knew best. It must be wonderful to be seventeen, and to know everything. Though he wished he wouldn't spend quite so much time now with that stupid Betty Schultz. True, she was very pretty - but, dammit, she was a girl! It was only with the greatest difficulty that they had been able to get rid of her this morning.

Dave was used to being a guinea pig; that was what younger brothers were for. He adjusted his face mask, put on his flippers, and slid into the crystalline water.

Bobby handed him the air hose with the old scuba mouthpiece they had taped to it. Dave took a breath, and grimaced.

'It tastes horrible.'

'You'll get used to it. In you go - no deeper than that ledge. That's where I'll start adjusting the pressure valve so we don't waste too much air. Come up when I tug the hose.'

Dave slid gently beneath the surface, and into wonderland. It was a peaceful, monochrome world, so different from the coral reefs of the Keys. There were none of the garish colours of the marine environment, where life - animal and vegetable - flaunted itself with all the hues of the rainbow. Here were only delicate shades of blue and green, and fish that looked like fish, not like butterflies.

He flippered slowly down, dragging the hose behind him, pausing to drink from its stream of bubbles whenever he felt the need. The sensation of freedom was so wonderful that he almost forgot the horrible oily taste in his mouth. When he reached the ledge - actually an ancient, waterlogged tree trunk, so overgrown with weeds that it was unrecognizable - he sat down and looked around him.

He could see right across the spring, to the green slopes at the far side of the flooded crater, at least a hundred metres away. There were not many fish around, but a small school went twinkling past like a shower of silver coins in the sunlight streaming down from above.

There was also an old friend stationed, as usual, at the gap where the waters of the spring began their journey to the sea. A small alligator ('but large enough,' Bobby had once said cheerfully. 'He's bigger than I am.') was hanging vertically, without visible means of support, only his nose above the surface. They had never bothered him, and he had never bothered them.

The air hose gave an impatient tug. Dave was happy to go; he had not realized how cold it could get at that hitherto unattainable depth - and he was also feeling distinctly sick. But the hot sunlight soon revived his spirits.

'No problems,' said Bobby expansively. 'Just keep unscrewing the valve so the pressure gauge doesn't drop below the red line.'

'How deep are you going?'

'All the way, if I feel like it.'

Dave did not take that seriously; they both knew about rapture of the depths and nitrogen narcosis. And in any case, the old garden hose was only thirty metres long. That would be plenty for this first experiment.

As he had done so many times before, he watched with envious admiration as his beloved elder brother accepted a new challenge. Swimming as effortlessly as the fish around him, Bobby glided downward into that blue, mysterious universe. He turned once and pointed vigorously to the air hose, making it unmistakably clear that he needed an increased air flow.

Despite the splitting headache that had suddenly come upon him, Dave remembered his duty. He hurried back to the ancient compressor, and opened the control valve to its deadly maximum - fifty parts per million of carbon monoxide.

The last he saw of Bobby was that confidently descending, sunlight-dappled figure passing forever beyond his reach. The wax statue in the funeral parlour was a total stranger, who had nothing to do with Robert Bowman.

33

Betty

Why had he come here, returning like an unquiet ghost to the scene of ancient anguish? He had no idea; indeed, he had not been conscious of his destination, until the round eye of Crystal Spring had gazed up at him from the forest below.

He was master of the world, yet he was paralysed by a sense of devastating grief he had not known for years. Time had healed the wound, as it always does; yet it seemed only yesterday that he had stood weeping beside the emerald

mirror, seeing only the reflections of the surrounding cypresses with their burden of Spanish moss. What was happening to him?

And now, still without deliberate volition, but as if swept by some gentle current, he was drifting northward, toward the state capital. He was looking for something; what it was, he would not know until he found it.

No one, and no instrument, detected his passage. He was no longer radiating wastefully, but had almost mastered his control of energy, as once he had mastered lost though not forgotten limbs. He sank like a mist into the earthquakeproof vaults, until he found himself among billions of stored memories, and dazzling, flickering networks of electronic thoughts.

This task was more complex than the triggering of a crude nuclear bomb, and took him a little longer. Before he found the information he was seeking, he made one trivial slip, but did not bother to correct it. No one ever understood why, the next month, three hundred Florida taxpayers, all of whose names began with F, received cheques for precisely one dollar. It cost many times the overpayment to straighten matters out, and the baffled computer engineers finally put the blame on a cosmic-ray shower. Which, on the whole, was not so very far from the truth.

In a few milliseconds, he had moved from Tallahassee to 634 South Magnolia Street, Tampa. It was still the same address; he need not have wasted time looking it up.

But then, he had never intended to look it up, until the very moment when he had done so.

After three births and two abortions, Betty Fernandez (née Schultz) was still a beautiful woman. At the moment she was also a very thoughtful one; she was watching a TV programme that brought back memories, bitter and sweet.

It was a News Special, triggered by the mysterious events of the preceding twelve hours, beginning with the warning that Leonov had beamed back from the moons of Jupiter. Something was heading for Earth; something had - harmlessly - detonated an orbiting nuclear bomb which no one had come forward to claim. That was all, but it was quite enough.

The news commentators had dredged up all the old videotapes - and some of them really were tapes - going back to the once top-secret records showing the discovery of TMA-l on the Moon. For the fiftieth time, at least, she heard that eerie radio shriek as the monolith greeted the lunar dawn and hurled its message toward Jupiter. And once again she watched the familiar scenes and listened to the old interviews aboard Discovery.

Why was she watching? It was all stored somewhere in the home archives (though she never played it back when José was around). Perhaps she was expecting some newsflash; she did not like to admit, even to herself, how much power the past still held over her emotions.

And there was Dave, as she had expected. It was an old BBC interview, of which she knew almost every word. He was talking about Hal, trying to decide whether the computer was self-conscious or not.

How young he looked - how different from those last blurred images from the doomed Discovery! And how much like Bobby as she remembered him.

The image wavered as her eyes filled with tears. No - something was wrong with the set, or the channel. Both sound and image were behaving erratically.

Dave's lips were moving, but she could hear nothing. Then his face seemed to dissolve, to melt into blocks of colour. It reformed, blurred again, and then was steady once more. But there was still no sound.

Where had they got this picture! This was not Dave as a man, but as a boy - as she had known him first. He was looking out of the screen almost as if he could see her across the gulf of years.

He smiled; his lips moved.

'Hello, Betty,' he said.

It was not hard to form the words, and to impose them on the currents pulsing in the audio circuits. The real difficulty was to slow down his thoughts to the glacial tempo of the human brain. And then to have to wait an eternity for the answer.

Betty Fernandez was tough; she was also intelligent, and though she had been a housewife for a dozen years, she had not forgotten her training as an electronics serviceperson. This was just another of the medium's countless miracles of simulation; she would accept it now, and worry about the details later.

'Dave,' she answered. 'Dave - is that really you?'

'I am not sure,' replied the image on the screen, in a curiously toneless voice. 'But I remember Dave Bowman, and everything about him.'

'Is he dead?'

Now that was another difficult question.

'His body - yes. But that is no longer important. All that Dave Bowman really was, is still part of me.'

Betty crossed herself - that was a gesture she had learned from José - and whispered:

'You mean - you're a spirit?'

'I do not know a better word.'

'Why have you returned?'

'Ah! Betty - why indeed! I wish you could tell me.'

Yet he knew one answer, for it was appearing on the TV screen. The divorce between body and mind was still far from complete, and not even the most complaisant of the cable networks would have transmitted the blatantly sexual images that were forming there now.

Betty watched for a little while, sometimes smiling, sometimes shocked. Then she turned away, not through shame but sadness - regret for lost delights.

'So it's not true,' she said, 'what they always told us about angels.'

Am I an angel? he wondered. But at least he understood what he was doing there, swept back by the tides of sorrow and desire to a rendezvous with his past. The most powerful emotion he had ever known had been his passion for Betty; the elements of grief and guilt it contained only made it stronger.

She had never told him if he was a better lover than Bobby; that was one question he had never asked, for that would have broken the spell. They had clung to the same illusion, sought in each other's arms (and how young he had been - still only seventeen when it had started, barely two years after the funeral!) a balm for the same wound.

Of course, it could not last, but the experience had left him irrevocably changed. For more than a decade, all his autoerotic fantasies had centred upon Betty; he had never found another woman to compare with her, and long ago had realized that he never would. No one else was haunted by the same beloved ghost.

The images of desire faded from the screen; for a moment, the regular programme broke through, with an incongruous shot of Leonov hanging above Io. Then Dave Bowman's face reappeared. He seemed to be losing control, for its lineaments were wildly unstable. Sometimes he would seem only ten years old - then twenty or thirty -then, incredibly, a wizened mummy whose wrinkled features were a parody of the man she had once known.

'I have one more question before I go. Carlos - you always said he was Jose's son, and I always wondered. What was the truth?'

Betty Fernandez stared for one long, last time into the eyes of the boy she had once loved (he was eighteen again, and for a moment she wished she could see his entire body, not merely his face).

'He was your son, David,' she whispered.

The image faded; the normal service resumed. When, almost an hour later, José Fernandez came quietly into the room, Betty was still staring at the screen.

She did not turn around as he kissed her on the back of the neck.

'You'll never believe this, José.'

'Try me.'

'I've just lied to a ghost.'

34

Valediction

When the American Institute of Aeronautics and Astronautics published its controversial summary Fifty Years of UFOs in 1997, many critics pointed out that

unidentified flying objects had been observed for centuries, and that Kenneth Arnold's 'Flying Saucer' sighting of 1947 had countless precedents. People had been seeing strange things in the sky since the dawn of history; but until the mid-twentieth century, UFOs were a random phenomenon of no general interest. After that date, they became a matter of public and scientific concern, and the basis for what could only be called religious beliefs.

The reason was not far to seek; the arrival of the giant rocket and the dawn of the Space Age had turned men's minds to other worlds. Realization that the human race would soon be able to leave the planet of its birth prompted the inevitable questions: Where's everyone, and when may we expect visitors? There was also the hope, though it was seldom spelled out in as many words, that benevolent creatures from the stars might help mankind heal its numerous self-inflicted wounds and save it from future disasters.

Any student of psychology could have predicted that so profound a need would be swiftly satisfied. During the last half of the twentieth century, there were literally thousands of reports of spacecraft sightings from every part of the globe. More than that, there were hundreds of reports of 'close encounters' - actual meetings with extraterrestrial visitors, frequently embellished by tales of celestial joyrides, abductions, and even honeymoons in space. The fact that, over and over again, these were demonstrated to be lies or hallucinations did nothing to deter the faithful. Men who had been shown cities on the far side of the Moon lost little credibility even when Orbiter surveys and Apollo revealed no artifacts of any kind; ladies who married Venusians were still believed when that planet, sadly, turned out to be hotter than molten lead.

By the time the ALAA published its report no reputable scientist - even among those few who had once espoused the idea- believed that UFOs had any connection with extraterrestrial life or intelligence. Of course, it would never be possible to prove that; any one of those myriad sightings, over the last thousand years, might have been the real thing. But as time went by, and satellite cameras and radars scanning the entire heavens produced no concrete evidence, the general public lost interest in the idea. The cultists, of course, were not discouraged, but kept the faith with their newsletters and books, most of them regurgitating and embellishing old reports long after they had been discredited or exposed.

When the discovery of the Tycho monolith - TMA-I - was finally announced, there was a chorus of 'I told you so's!' It could no longer be denied that there had been visitors to the Moon - and presumably to the Earth as well - a little matter of three million years ago. At once, UFOs infested the heavens again; though it was odd that the three independent national tracking systems, which could locate anything in space larger than a ballpoint pen, were still unable to find them.

Rather quickly, the number of reports dropped down to the 'noise level' once more - the figure that would be expected, merely as a result of the many astronomical, meteorological, and aeronautical phenomena constantly occurring in the skies.

But now it had started all over again. This time, there was no mistake; it was official. A genuine UFO was on its way to Earth.

Sightings were reported within minutes of the warning from Leonov; the first close encounters were only a few hours later. A retired stockbroker, walking his bulldog on the Yorkshire Moors, was astonished when a disk-shaped craft landed

beside him and the occupant - quite human, except for the pointed ears - asked the way to Downing Street. The contactee was so surprised that he was only able to wave his stick in the general direction of Whitehall; conclusive proof of the meeting was provided by the fact that the bulldog now refused to take his food.

Although the stockbroker had no previous history of mental illness, even those who believed him had some difficulty in accepting the next report. This time it was a Basque shepherd on a traditional mission; he was greatly relieved when what he had feared to be border guards turned out to be a couple of cloaked men with piercing eyes, who wanted to know the way to the United Nations Headquarters.

They spoke perfect Basque - an excruciatingly difficult tongue with no affinity to any other known language of mankind. Clearly, the space visitors were remarkable linguists, even if their geography was oddly deficient.

So it went on, case after case. Very few of the contactees were actually lying or insane; most of them sincerely believed their own stories, and retained that belief even under hypnosis. And some were just victims of practical jokes or improbable accidents - like the unlucky amateur archaeologists who found the props that a celebrated science-fiction moviemaker had abandoned in the Tunisian desert almost four decades earlier.

Yet only at the beginning - and at the very end - was any human being genuinely aware of his presence; and that was because he so desired it.

The world was his to explore and examine as he pleased, without restraint or hindrance. No walls could keep him out, no secrets could be hidden from the senses he possessed. At first he believed that he was merely fulfilling old ambitions, by visiting the places he had never seen in that earlier existence. Not until much later did he realize that his lightning-like sallies across the face of the globe had a deeper purpose.

In some subtle way, he was being used as a probe, sampling every aspect of human affairs. The control was so tenuous that he was barely conscious of it; he was rather like a hunting dog on a leash, allowed to make excursions of his own, yet nevertheless compelled to obey the overriding wishes of his master.

The pyramids, the Grand Canyon, the moon-washed snows of Everest - these were choices of his own. So were some art galleries and concert halls; though he would certainly, on his own initiative, never have endured the whole of the Ring.

Nor would he have visited so many factories, prisons, hospitals, a nasty little war in Asia, a racecourse, a complicated orgy in Beverly Hills, the Oval Room of the White House, the Kremlin archives, the Vatican Library, the sacred Black Stone of the Kaabah at Mecca.

There were also experiences of which he had no clear memory, as if they had been censored - or he was being protected from them by some guardian angel. For example -What was he doing at the Leakey Memorial Museum, in Olduvai Gorge? He had no greater interest in the origin of Man than any other intelligent member of the species H. sapiens, and fossils meant nothing to him. Yet the famous skulls, guarded like crown jewels in their display cases, aroused strange echoes in his memory, and an excitement for which he was unable to account. There was a

feeling of déja vu stronger than any he had ever known; the place should be familiar - but something was wrong. It was like a house to which one returns after many years, to find that all the furniture has been changed, the walls moved, and even the stairways rebuilt.

It was bleak, hostile terrain, dry and parched. Where were the lush plains and the myriad fleet-footed herbivores that had roamed across them, three million years ago?

Three million years. How had he known that?

No answer came from the echoing silence into which he had thrown the question. But then he saw, once more looming before him, a familiar black rectangular shape. He approached, and a shadowy image appeared in its depths, like a reflection in a pool of ink.

The sad and puzzled eyes that stared back from beneath that hairy, receding forehead looked beyond him into a future they could never see. For he was that future, a hundred thousand generations further down the stream of time.

History had begun there; that at least he now understood. But how - and above all, why - were secrets still withheld from him?

But there was one last duty, and that was hardest of all. He was still sufficiently human to put it off until the very end.

Now what's she up to? the duty nurse asked herself, zooming the TV monitor onto the old lady. She's tried lots of tricks, but this is the first time I've seen her talking to her hearing aid, for goodness sake. I wonder what she's saying?

The microphone was not sensitive enough to pick up the words, but that scarcely seemed to matter. Jessie Bowman had seldom looked so peaceful and content. Though her eyes were closed, her entire face was wreathed in an almost angelic smile while her lips continued to form whispered words.

And then the watcher saw something that she tried hard to forget because to report it would instantly disqualify her in the nursing profession. Slowly and jerkily, the comb lying on the bedside table raised itself in the air as if lifted by clumsy, invisible fingers.

On the first attempt, it missed; then, with obvious difficulty, it began to part the long silver strands, pausing sometimes to disentangle a knot.

Jessie Bowman was not speaking now, but she continued to smile. The comb was moving with more assurance, and no longer in abrupt, uncertain jerks.

How long it lasted the nurse could never be certain. Not until the comb was gently replaced on the table did she recover from her paralysis.

Ten-year-old Dave Bowman had finished the chore which he always hated but which his mother loved. And a David Bowman who was now ageless had gained his first control of obdurate matter.

Jessie Bowman was still smiling when the nurse finally came to investigate. She had been too scared to hurry; but it would have made no difference anyway.

35

Rehabilitation

The uproar of Earth was comfortably muted, across the millions of kilometres of space. Leonov's crew watched, with fascination yet with a certain detachment, the debates in the United Nations, the interviews with distinguished scientists', the theorizing of the news commentators, the matter-of-fact yet wildly conflicting accounts of the UFO contactees. They could contribute nothing to the brouhaha, for they had witnessed no further manifestations of any kind. Zagadka, alias Big Brother, remained as blankly indifferent to their presence as ever. And that was indeed an ironic situation; they had come all the way from Earth to solve a mystery - and it looked as if the answer might be right back at their starting point.

For the first time, they felt grateful for the slow velocity of light, and the two-hour delay that made live interviews impossible on the Earth-Jupiter circuit. Even so, Floyd was badgered by so many media requests that he finally went on strike. Nothing more remained to be said, and he had said it at least a dozen times.

Besides, there was still much work to be done. Leonov had to be prepared for the long journey home, so that it would be ready to depart immediately when the launch window opened. The timing was not at all critical; even if they missed by a month, that would merely prolong the trip. Chandra, Curnow, and Floyd would not even notice as they slept their way toward the Sun; but the rest of the crew was grimly determined to leave just as soon as the laws of celestial mechanics permitted.

Discovery still posed many problems. The ship had barely sufficient propellant for the return to Earth, even if it left much later than Leonov and flew a minimum-energy orbit - which would take almost three years. And this would be possible only if Hal could be reliably programmed to carry out the mission with no human intervention except long-range monitoring. Without his cooperation, Discovery would have to be abandoned once again.

It had been fascinating - indeed, deeply moving - to watch the steady regrowth of Hal's personality, from brain-damaged child to puzzled adolescent and at length to slightly condescending adult. Although he knew that such anthropomorphic labels were highly misleading, Floyd found it quite impossible to avoid them.

And there were times when he felt that the whole situation had a haunting familiarity. How often he had seen videodramas in which disturbed youngsters were straightened out by all-wise descendants of the legendary Sigmund Freud! Essentially the same story was being played out in the shadow of Jupiter.

The electronic psychoanalysis had proceeded at a speed totally beyond human comprehension as repair and diagnostic programs flashed through Hal's circuits at billions of bits a second, pinpointing possible malfunctions and correcting

them. Though most of these programs had been tested in advance on Hal's twin, SAL 9000, the impossibility of a real-time dialogue between the two computers was a serious handicap. Sometimes hours were wasted when it proved necessary to check back with Earth at a critical point in the therapy.

For despite all Chandra's work, the computer's rehabilitation was still far from complete. Hal exhibited numerous idiosyncrasies and nervous tics, sometimes even ignoring spoken words - though he would always acknowledge keyboard inputs from anyone. In the reverse direction, his outputs were even more eccentric.

There were times when he would give verbal replies, but would not display them visually. At other times he would do both - but refused to print hard copy. He would give no excuses or explanations - not even the stubbornly impenetrable 'I prefer not to' of Melville's autistic scrivener, Bartelby.

However, he was not actively disobedient so much as reluctant, and only where certain tasks were concerned. It was always possible to win his cooperation eventually - 'to talk him out of his sulk', as Curnow put it neatly.

It was not surprising that Dr Chandra was beginning to show the strain. On one celebrated occasion when Max Brailovsky innocently revived an old canard, he almost lost his temper.

'Is it true, Dr Chandra, that you chose the name Hal to be one step ahead of IBM?'

'Utter nonsense! Half of us come from IBM and we've been trying to stamp out that story for years. I thought that by now every intelligent person knew that H-A-L is derived from Heuristic ALgorithmic.'

Afterward, Max swore that he could distinctly hear the capital letters.

In Floyd's private opinion, the odds were at least fifty to one against flying Discovery safely back to Earth. And then Chandra came to him with an extraordinary proposal.

'Dr Floyd, can I have a word with you?'

After all the weeks and shared experiences, Chandra was still as formal as ever - not only to Floyd, but to all the crew. He would not even address the ship's baby, Zenia, without the prefix 'ma'am'.

'Of course, Chandra. What is it?'

'I've virtually completed the programming for the six most probable variations on the Hohmann return orbit. Five have now been run on a simulation, without any problems.'

'Excellent. I'm sure that no one else on Earth - in the Solar System - could have done it.'

'Thank you. However, you know as well as I do that it's impossible to program for every eventuality. Hal may - will - function perfectly, and will be able to handle any reasonable emergency. But all sorts of trivial accidents - minor equipment failures that could be fixed with a screwdriver, broken wires, stuck switches - could leave him helpless and abort the whole mission.'

'You're absolutely right, of course, and it's been worrying me. But what can we do about it?'

'It's really quite simple. I'd like to stay with Discovery.'

Floyd's immediate reaction was that Chandra had gone crazy. On second thoughts, perhaps he was only half crazy. It might indeed make all the difference between success and failure to have a human being - that superb all-purpose trouble-shooting and repair device - aboard Discovery for the long voyage back to Earth. But the objections were completely overwhelming.

'It's an interesting idea,' Floyd answered with extreme caution, 'and I certainly appreciate your enthusiasm. But have you thought of all the problems?' That was a silly thing to say; Chandra would have all the answers already filed away for immediate retrieval.

'You'll be on your own for over three years! Suppose you had an accident or a medical emergency?'

'That's a risk I'm prepared to take.'

'And what about food, water? Leonov doesn't have enough to spare.'

'I've checked Discovery's recycling system; it can be made operational again without too much difficulty. Besides, we Indians can manage on very little.'

It was unusual for Chandra to refer to his origins, or indeed to make any personal statements; his 'true confession' was the only example Floyd could remember. But he did not doubt the claim; Curnow had once remarked that Dr Chandra had the sort of physique that could only be achieved by centuries of starvation. Although it sounded like one of the engineer's unkinder wisecracks, it had been made entirely without malice - indeed, with sympathy; though not, of course, in Chandra's hearing.

'Well, we still have several weeks to decide. I'll think it over and talk to Washington.'

'Thank you; do you mind if I start making the arrangements?'

'Er - not at all, as long as they don't interfere with the existing plans. Remember - Mission Control will have to make the final decision.'

And I know exactly what Mission Control will say. It was madness to expect a man to survive in space for three, years, alone.

But, of course, Chandra had always been alone.

36

Fire in the Deep

Earth was already far behind, and the awesome wonders of the Jovian system were expanding swiftly before him, when he had his revelation.

How could he have been so blind - so stupid! It was as if he had been walking in his sleep; now he was starting to awaken.

Who are you? he cried. What do you want? Why have you done this to me?

There was no answer, yet he was certain that he had been heard. He sensed a... presence, even as a man can tell, though his eyes are tightly shut, that he is in a closed room and not some empty, open space. Around him there was the faint echo of a vast mentality, an implacable will.

He called again into the reverberant silence, and again there was no direct reply - only that sense of watchful companionship. Very well; he would find the answers for himself.

Some were obvious; whoever or whatever they were, they were interested in Mankind. They had tapped and stored his memories, for their own inscrutable purposes. And now they had done the same with his deepest emotions, sometimes with his cooperation, sometimes without.

He did not resent that; indeed, the very processing he had experienced made such childish reactions impossible. He was beyond love and hate and desire and fear - but he had not forgotten them, and could still understand how they ruled the world of which he had once been part. Was that the purpose of the exercise? If so, for what ultimate goal?

He had become a player in a game of gods, and must learn the rules as he went along.

The jagged rocks of the four tiny outer moons, Sinope, Pasiphae, Carme, and Ananke, flickered briefly across his field of consciousness; then came Elara, Lysithea, Himalia, and Leda at half their distance from Jupiter. He ignored them all; now the pock-marked face of Callisto lay ahead.

Once, twice, he orbited the battered globe, larger than Earth's own Moon, while senses of which he had been unaware probed its outer layers of ice and dust. His curiosity was quickly satisfied; the world was a frozen fossil, still bearing the marks of collisions that, aeons ago, must have come close to shattering it. One hemisphere was a giant bull's-eye, a series of concentric rings where solid rock had once flowed in kilometre-high ripples under some ancient hammer blow from space.

Seconds later, he was circling Ganymede. Now there was a far more complex and interesting world; though so near to Callisto, and almost the same size, it presented an utterly different appearance. There were, it was true, numerous craters - but most of them seemed to have been, quite literally, ploughed back into the ground. The most extraordinary feature of the Ganymedean landscape was the presence of meandering stripes, built up from scores of parallel furrows a few kilometres apart. This grooved terrain looked as if it had been produced by armies of intoxicated ploughmen, weaving back and forth across the face of the satellite.

In a few revolutions, he saw more of Ganymede than all the space probes ever sent from Earth, and filed away the knowledge for future use. One day it would be important; he was sure of that, though he did not know why - any more than he

understood the impulse that was now driving him so purposefully from world to world.

As, presently, it brought him to Europa. Though he was still largely a passive spectator, he was aware now of a rising interest, a focusing of attention - a concentration of will. Even if he was a puppet in the hands of an unseen and uncommunicative master, some of the thoughts of that controlling influence leaked - or were allowed to leak - into his own mind.

The smooth, intricately patterned globe now, rushing toward him bore little resemblance either to Ganymede or Callisto. It looked organic; the network of lines branching and intersecting over its entire surface was uncannily like a world-spanning system of veins and arteries.

The endless ice fields of a frigid waste, far colder than the Antarctic, stretched beneath him. Then, with brief surprise, he saw that he was passing over the wreckage of a spaceship. He recognized it instantly as the ill-fated Tsien, featured in so many of the video newscasts he had analysed. Not now - not now - there would be ample opportunity later.

Then he was through the ice, and into a world as unknown to his controllers as to himself.

It was an ocean world, its hidden waters protected from the vacuum of space by a crust of ice. In most places the ice was kilometres thick, but there were lines of weakness where it had cracked open and torn apart. Then there had been a brief battle between two implacably hostile elements that came into direct contact on no other world in the Solar System. The war between Sea and Space always ended in the same stalemate; the exposed water simultaneously boiled and froze, repairing the armour of ice.

The seas of Europa would have frozen completely solid long ago without the influence of nearby Jupiter. Its gravity continually kneaded the core of the little world; the forces that convulsed Io were working there, though with much less ferocity. As he skimmed across the face of the deep, he saw everywhere the evidence of that tug-of-war between planet and satellite.

And he both heard and felt it, in the continual roar and thunder of submarine earthquakes, the hiss of escaping gases from the interior, the infrasonic pressure waves of avalanches sweeping over the abyssal plains. By comparison with the tumultuous ocean that covered Europa, even the noisy seas of Earth were silent.

He had not lost his sense of wonder, and the first oasis filled him with delighted surprise. It extended for almost a kilometre around a tangled mass of pipes and chimneys deposited by mineral brines gushing from the interior. Out of that natural parody of a Gothic castle, black, scalding liquids pulsed in a slow rhythm, as if driven by the beating of some mighty heart. And, like blood, they were the authentic sign of life itself.

The boiling fluids drove back the deadly cold leaking down from above, and formed an island of warmth on the seabed. Equally important, they brought from Europa's interior all the chemicals of life. There, in an environment where none had expected it, were energy and food, in abundance.

Yet it should have been expected; he remembered that, only a lifetime ago, such fertile oases had been discovered in the deep oceans of Earth. Here they were present on an immensely larger scale, and in far greater variety.

In the tropical zone close to the contorted walls of the 'castle' were delicate, spidery structures that seemed to be the analogy of plants, though almost all were capable of movement. Crawling among these were bizarre slugs and worms, some feeding on the plants, others obtaining their food directly from the mineral-laden waters around them. At greater distances from the source of heat - the submarine fire around which all the creatures warmed themselves - were sturdier, more robust organisms, not unlike crabs or spiders.

Armies of biologists could have spent lifetimes studying that one small oasis. Unlike the Palaeozoic terrestrial seas, it was not a stable environment, so evolution had progressed swiftly here, producing multitudes of fantastic forms. And they were all under indefinite stay of execution; sooner or later, each fountain of life would weaken and die, as the forces that powered it moved their focus elsewhere.

Again and again, in his wanderings across the Europan seabed, he encountered the evidence of such tragedies. Countless circular areas were littered with the skeletons and mineral-encrusted remains of dead creatures, where entire chapters of evolution had been deleted from the book of life.

He saw huge, empty shells formed like convoluted trumpets as large as a man. There were clams of many shapes - bivalves, and even trivalves. And there were spiral stone patterns, many metres across, which seemed an exact analogy of the beautiful ammonites that disappeared so mysteriously from Earth's oceans at the end of the Cretaceous Period.

Searching, seeking, he moved back and forth over the face of the abyss. Perhaps the greatest of all the wonders he met was a river of incandescent lava, flowing for a hundred kilometres along a sunken valley. The pressure at that depth was so great that the water in contact with the red-hot magma could not flash into steam, and the two liquids coexisted in an uneasy truce.

There, on another world and with alien actors, something like the story of Egypt had been played long before the coming of man. As the Nile had brought life to a narrow ribbon of desert, so this river of warmth had vivified the Europan deep. Along its banks, in a band never more than two kilometres wide, species after species had evolved and flourished and passed away. And at least one had left a monument behind it.

At first, he thought that it was merely another of the encrustations of mineral salts that surrounded almost all the thermal vents. However, as he came closer, he saw that it was not a natural formation, but a structure created by intelligence. Or perhaps by instinct; on Earth, the termites reared castles that were almost equally imposing, and the web of a spider was more exquisitely designed.

The creatures that had lived there must have been quite small, for the single entrance was only half a metre wide. That entrance - a thick-walled tunnel, made by heaping rocks on top of each other - gave a clue to the builders' intentions. They had reared a fortress, there in the flickering glow not far from the banks of their molten Nile. And then they had vanished.

They could not have left more than a few centuries before. The walls of the fortress, built from irregularly shaped rocks that must have been collected with great labour, were covered with only a thin crust of mineral deposits. One piece of evidence suggested why the stronghold had been abandoned. Part of the roof had fallen in, perhaps owing to the continual earthquakes; and in an underwater environment, a fort without a roof was wide open to an enemy.

He encountered no other sign of intelligence along the river of lava. Once, however, he saw something uncannily like a crawling man - except that it had no eyes and no nostrils, only a huge, toothless mouth that gulped continuously, absorbing nourishment from the liquid medium around it.

Along the narrow band of fertility in the deserts of the deep, whole cultures and even civilizations might have risen and fallen, armies might have marched (or swum) under the command of Europan Tamberlanes or Napoleons. And the rest of their world would never have known, for all those oases of warmth were as isolated from one another as the planets themselves. The creatures who basked in the glow of the lava river, and fed around the hot vents, could not cross the hostile wilderness between their lonely islands, If they had ever produced historians and philosophers, each culture would have been convinced that it was alone in the Universe.

Yet even the space between the oases was not altogether empty of life; there were hardier creatures who had dared its rigours. Often swimming overhead were the Europan analogues of fish - streamlined torpedoes, propelled by vertical tails, steered by fins along their bodies. The resemblance to the most successful dwellers in Earth's oceans was inevitable; given the same engineering problems, evolution must produce very similar answers. As witness the dolphin and the shark - superficially almost identical, yet from far distant branches of the tree of life.

There was, however, one very obvious difference between the fish of the Europan seas and those in terrestrial oceans; they had no gills, for there was hardly a trace of oxygen to be extracted from the waters in which they swam. Like the creatures around Earth's own geothermal vents, their metabolism was based on sulphur compounds, present in abundance in the near-volcanic environment.

And very few had eyes. Apart from the flickering glow of the rare lava outpourings, and occasional bursts of bioluminescence from creatures seeking mates, or hunters questing prey, it was a lightless world.

It was also a doomed one. Not only were its energy sources sporadic and constantly shifting, but the tidal forces that drove them were steadily weakening. Even if they developed true intelligence, the Europans must perish with the final freezing of their world.

They were trapped between fire and ice.

37

Estrangement

'I'm truly sorry, old friend, to be the bearer of such bad news, but Caroline has asked me, and you know how I feel about you both.

'And I don't think it can be such a surprise. Some of the remarks you've made to me over the last year have hinted at it... and you know how bitter she was when you left Earth.

'No, I don't believe there's anyone else. If there was, she'd have told me... But sooner or later - well, she's an attractive young woman.

'Chris is fine, and of course he doesn't know what's happening. At least he won't be hurt. He's too young to understand, and children are incredibly... elastic? - just a minute, I'll have to key my thesaurus... ah, resilient.

'Now to things that may seem less important to you. Everyone is still trying to explain that bomb detonation as an accident, but of course nobody believes it. Because nothing else has happened, the general hysteria has died down; we're left with what one of your commentators has called the "looking-over-the-shoulder syndrome".

'And someone has found a hundred-year-old poem that sums up the situation so neatly that everybody's quoting it. It's set in the last days of the Roman Empire, at the gates of a city whose occupants are waiting for invaders to arrive. The emperor and dignitaries are all lined up in their most costly togas, ready with speeches of welcome. The senate has closed, because any laws it passes today will be ignored by the new masters.

'Then, suddenly, a dreadful piece of news arrives from the frontier. There aren't any invaders. The reception committee breaks up in confusion; everyone goes home muttering disappointedly, "Now what will happen to us? Those people were a kind of solution."

'There's just one slight change needed to bring the poem up to date. It's called "Waiting for the Barbarians" - and this time, we are the barbarians. And we don't know what we're waiting for, but it certainly hasn't arrived.

'One other item. Had you heard that Commander Bowman's mother died only a few days after the thing came to Earth? It does seem an odd coincidence, but the people at her nursing home say that she never showed the slightest interest in the news, so it couldn't possibly have affected her.'

Floyd switched off the recording. Dimitri was right; he was not taken by surprise. But that made not the slightest difference; it hurt just as badly.

Yet what else could he have done? If he had refused to go on the mission - as Caroline had so clearly hoped - he would have felt guilty and unfulfilled for the remainder of his life. That would have poisoned his marriage; better this clean break, when physical distance softened the pain of separation. (Or did it? In some ways, it made things worse.) More important was duty, and the sense of being part of a team devoted to a single goal.

So Jessie Bowman was gone. Perhaps that was another cause for guilt. He had helped to steal her only remaining son, and that must have contributed to her mental breakdown. Inevitably, he was reminded of a discussion that Walter Curnow had started, on that very subject.

'Why did you choose Dave Bowman? He always struck me as a cold fish - not actually unfriendly, but whenever he came into the room, the temperature seemed to drop ten degrees.'

'That was one of the reasons we did select him. He had no close family ties, except for a mother he didn't see very often. So he was the sort of man we could send on a long, open-ended mission.'

'How did he get that way?'

'I suppose the psychologists could tell you. I did see his report, of course, but that was a long time ago. There was something about a brother who was killed - and his father died soon afterward, in an accident on one of the early shuttles. I'm not supposed to tell you this, but it certainly doesn't matter now.'

It didn't matter; but it was interesting. Now Floyd almost envied David Bowman, who had come to that very spot a free man unencumbered by emotional ties with Earth.

No - he was deceiving himself. Even while the pain gripped his heart like a vice, what he felt for David Bowman was not envy, but pity.

38

Foamscape

The last beast he saw, before he left the oceans of Europa, was much the largest. It closely resembled one of the banyan trees from Earth's tropics, whose scores of trunks allow a single plant to create a small forest sometimes covering hundreds of square metres. The specimen, however, was walking, apparently on a trek between oases. If it was not one of the creatures that had destroyed Tsien, it certainly belonged to a very similar species.

Now he had learned all that he needed to know - or, rather, all that they needed to know. There was one more moon to visit; seconds later, the burning landscape of Io lay below him.

It was as he had expected. Energy and food were there in abundance, but the time was not yet ripe for their union. Around some of the cooler sulphur lakes, the first steps had been taken on the road to life, but before any degree of organization had occurred, all such bravely premature attempts were thrown back into the melting pot. Not until the tidal forces that drove Io's furnaces had lost their power, millions of years later, would there be anything to interest biologists on that seared and sterilized world.

He wasted little time on Io, and none at all on the tiny inner moons that skirted Jupiter's ghostly rings - themselves only pale shadows of the glory that was Saturn's. The greatest of worlds lay before him; he would know it as no man had ever done, or ever would.

The million-kilometre-long tendrils of magnetic force, the sudden explosions of radio waves, the geysers of electrified plasma wider than the planet Earth- they were as real and clearly visible to him as the clouds banding the planet in multihued glory. He could understand the complex pattern of their interactions, and realized that Jupiter was much more wonderful than anyone had ever guessed.

Even as he fell through the roaring heart of the Great Red Spot, with the lightning of its continent-wide thunderstorms detonating around him, he knew why it had persisted for centuries though it was made of gases far less substantial than those that formed the hurricanes of Earth. The thin scream of hydrogen wind faded as he sank into the calmer depths, and a sleet of waxen snowflakes - some already coalescing into barely palpable mountains of hydrocarbon foam - descended from the heights above. It was already warm enough for liquid water to exist, but there were no oceans there; that purely gaseous environment was too tenuous to support them.

He descended through layer after layer of cloud, until he entered a region of such clarity that even human vision could have scanned an area more than a thousand kilometres across. It was only a minor eddy in the vaster gyre of the Great Red Spot; and it held a secret that men had long guessed, but never proved.

Skirting the foothills of the drifting foam mountains were myriads of small, sharply-defined clouds, all about the same size and patterned with similar red and brown mottlings. They were small only as compared with the inhuman scale of their surroundings; the very least would have covered a fair-sized city.

They were clearly alive, for they were moving with slow deliberation along the flanks of the aerial mountains, browsing off their slopes like colossal sheep. And they were calling to each other in the metre band, their radio voices faint but clear against the cracklings and concussions of Jupiter itself.

Nothing less than living gasbags, they floated in the narrow zone between freezing heights and scorching depths. Narrow, yes - but a domain far larger than all the biosphere of Earth.

They were not alone. Moving swiftly among them were other creatures so small that they could easily have been overlooked. Some of them bore an almost uncanny resemblance to terrestrial aircraft and were of about the same size. But they too were alive - perhaps predators, perhaps parasites, perhaps even herdsmen.

A whole new chapter of evolution, as alien as that which he had glimpsed on Europa, was opening before him. There were jet-propelled torpedoes like the squids of the terrestrial oceans, hunting and devouring the huge gasbags. But the balloons were not defenceless; some of them fought backs with electric thunderbolts and with clawed tentacles like kilometre-long chainsaws.

There were even stranger shapes, exploiting almost every possibility of geometry - bizarre, translucent kites, tetrahedra, spheres, polyhedra, tangles of twisted ribbons.

The gigantic plankton of the Jovian atmosphere, they were designed to float like gossamer in the uprising currents, until they had lived long enough to reproduce; then they would be swept down into the depths to be carbonized and recycled in a new generation.

He was searching a world more than a hundred times the area of Earth, and though he saw many wonders, nothing there hinted of intelligence. The radio voices of the great balloons carried only simple messages of warning or of fear. Even the hunters, who might have been expected to develop higher degrees of organization, were like the sharks in Earth's oceans - mindless automata.

And for all its breathtaking size and novelty, the biosphere of Jupiter was a fragile world, a place of mists and foam, of delicate silken threads and paper-thin tissues spun from the continual snowfall of petrochemicals formed by lightning in the upper atmosphere. Few of its constructs were more substantial than soap bubbles; its most terrifying predators could be torn to shreds by even the feeblest of terrestrial carnivores.

Like Europa on a vastly grander scale, Jupiter was an evolutionary cul-de-sac. Consciousness would never emerge here; even if it did, it would be doomed to a stunted existence. A purely aerial culture might develop, but in an environment where fire was impossible, and solids scarcely existed, it could never even reach the Stone Age.

And now, as he hovered above the centre of a Jovian cyclone merely as large as Africa, he became aware once again of the presence controlling him. Moods and emotions were leaking into his own consciousness, though he could not identify any specific concepts or ideas. It was as if he were listening, outside a closed door, to a debate in progress, and in a language he could not understand. But the muffled sounds clearly conveyed disappointment, then uncertainty, then a sudden determination - though for what purpose he could not tell. Once again, he felt like a pet dog, able to share his master's changing moods but not to comprehend them.

And then the invisible leash was taking him down toward the heart of Jupiter. He was sinking through the clouds, below the level where any form of life was possible.

Soon he was beyond the reach of the last rays from the faint and distant Sun. The pressure and temperature were swiftly mounting; already it was above the boiling point of water, and he passed briefly through a layer of superheated steam. Jupiter was like an onion; he was peeling it away skin by skin, though as yet he had travelled only a fraction of the distance to its core.

Beneath the steam was a witches' brew of petrochemicals - enough to power for a million years all the internal-combustion engines that mankind had dyer built. It became thicker and denser; then, quite abruptly, it ended at a discontinuity only a few kilometres thick.

Heavier than any rocks on Earth, yet still a liquid, the next shell consisted of silicon and carbon compounds of a complexity that could have provided lifetimes of work for terrestrial chemists. Layer followed layer for thousands of kilometres, but as the temperature rose into the hundreds and then the thousands of degrees, the composition of the various strata became simpler and simpler. Halfway down to the core, it was too hot for chemistry; all compounds were torn apart, and only the basic elements could exist.

Next there came a deep sea of hydrogen - but not hydrogen as it had ever existed for more than a fraction of a second in any laboratory on Earth. This hydrogen was under such enormous pressure that it had become a metal.

He had almost reached the centre of the planet, but Jupiter had one more surprise in store. The thick shell of metallic yet still fluid hydrogen ended abruptly. At last, there was a solid surface, sixty thousand kilometres down.

For ages, the carbon baked out of the chemical reactions far above had been drifting down toward the centre of the planet. There it had gathered, crystallizing at a pressure of millions of atmospheres. And there, by one of Nature's supreme jests, was something very precious to mankind.

The core of Jupiter, forever beyond human reach, was a diamond as big as the Earth.

39

In the Pod Bay

'Walter - I'm worried about Heywood.'

'I know, Tanya - but what can we do?'

Curnow had never seen Commander Orlova in so indecisive a mood; it made her seem much more appealing, despite his prejudice against small women.

'I'm very fond of him, but that's not the reason. His - I suppose gloom is the best word for it - is making everyone miserable. Leonov has been a happy ship. I want to keep it that way.'

'Why don't you talk to him? He respects you, and I'm sure he'll do his best to snap out of it.'

'I intend to do just that. And if it doesn't work -' 'Well?'

'There's one simple solution. What more can he do on this trip? When we start back for home, he'll be in hibernation anyway. We could always - what do you say, jump the gun on him.'

'Phew - the same dirty trick that Katerina played on me. He'd be mad when he woke up.'

'But also safely back on Earth, and very busy. I'm sure he'd forgive us.'

'I don't think you're serious. Even if I backed you up, Washington would raise hell. Besides, suppose something happened, and we really need him badly? Isn't there a two-week buffer period, before you can revive anyone safely?'

'At Heywood's age, more like a month. Yes, we'd be committed. But what do you think could happen now? He's done the job he was sent for - apart from keeping an eye on us. And I'm sure you've been well briefed about that in some obscure suburb of Virginia or Maryland.'

'I neither confirm nor deny. And frankly, I'm a lousy undercover agent. I talk too much, and I hate Security. I've fought all my life to keep my rating below Restricted. Every time there was danger of being reclassified Confidential

or, worse still, Secret, I'd go and create a scandal. Though that's getting very difficult nowadays.'

'Walter, you're incorrupt -'

'Incorrigible?'

'Yes, that's the word I meant. But back to Heywood, please. Would you like to talk to him first?'

'You mean - give him a pep talk? I'd rather help Katerina drive in the needle. Our psychologies are too different. He thinks I'm a loudmouthed clown.'

'Which you often are. But that's only to hide your real feelings. Some of us have evolved the theory that deep down inside you is a really nice person, struggling to get out.'

For once, Curnow was at a loss for words. Finally he mumbled: 'Oh, very well - I'll do my best. But don't expect miracles; my profile gave me Z for tact. Where's he hiding at the moment?'

'In the Pod Bay. He claims he's working on his final report, but I don't believe it. He just wants to get away from us all, and that's the quietest place.'

That was not the reason, though it was indeed an important one. Unlike the carousel, where most of the action aboard Discovery was then taking place, the Pod Bay was a zero-gee environment.

Right at the beginning of the Space Age, men had discovered the euphoria of weightlessness and remembered the freedom they had lost when they left the ancient womb of the sea. Beyond gravity, some of that freedom was regained; with the loss of weight went many of the cares and worries of Earth.

Heywood Floyd had not forgotten his sorrow, but it was more bearable there. When he was able to look at the matter dispassionately, he was surprised at the strength of his reaction to an event not wholly unexpected. More than loss of love was involved, though that was the worst part. The blow had come when he was particularly vulnerable, at the very moment when he was feeling a sense of anticlimax, even futility.

And he knew precisely why. He had achieved all that he had been expected to do, thanks to the skill and cooperation of his colleagues (he was letting them down, he knew, by his present selfishness). If all went well - that litany of the Space Age! - they would return to Earth with a cargo of knowledge that no expedition had ever gathered before, and a few years later even the once-lost Discovery would be restored to her builders.

It was not enough. The overpowering enigma of Big Brother remained out there, only a few kilometres away, mocking all human aspirations and achievements. Just as its analogue on the Moon had done, a decade ago, it had come to life for a moment, then relapsed into stubborn inertness. It was a closed door upon which they had hammered in vain. Only David Bowman, it seemed, had ever found the key.

Perhaps that explained the attraction he felt for the quiet and sometimes even mysterious place. From there - from that now empty launch cradle - Bowman

had left on his last mission, through the circular hatchway that led to infinity.

He found the thought exhilarating rather than depressing; certainly it helped to distract him from his personal problems. Nina's vanished twin was part of the history of space exploration; it had travelled, in the words of the hoary old cliché that always evoked a smile yet an acknowledgement of its fundamental truth, 'where no man had gone before...' Where was it now? Would he ever know?

He would sometimes sit for hours in the crowded but not cramped little capsule, trying to collect his thoughts and occasionally dictating notes; the other crew members respected his privacy, and understood the reason for it. They never came near the Pod Bay, and had no need to do so. Its refurbishment was a job for the future, and some other team.

Once or twice, when he had felt really depressed, he found himself thinking: Suppose I ordered Hal to open the Pod Bay doors, and set out along Dave Bowman's trail? Would I be greeted by the miracle he saw and which Vasili glimpsed a few weeks ago? It would solve all my problems...

Even if the thought of Chris did not deter him, there was an excellent reason why so suicidal a move was out of the question. Nina was a very complex piece of equipment; he could no more operate her than fly a fighter aircraft.

He was not meant to be an intrepid explorer: that particular fantasy would remain unrealized.

Walter Curnow had seldom undertaken a mission with more reluctance. He felt genuinely sorry for Floyd, but at the same time a little impatient with the other's distress. His own emotional life was broad but shallow; he had never put all his eggs in one basket. More than once he had been told that he spread himself too thin, and though he had never regretted it, he was beginning to think it was time to settle down.

He took the shortcut through the carousel control centre, noting that the Maximum Speed Reset Indicator was still flashing idiotically. A major part of his job was deciding when warnings could be ignored, when they could be dealt with at leisure - and when they had to be treated as real emergencies. If he paid equal attention to all the ship's cries for help, he would never get anything done.

He drifted along the narrow corridor that led to the Pod Bay, propelling himself by occasional flicks against the rungs on the tubular wall. The pressure gauge claimed that there was vacuum on the other side of the airlock door, but he knew better. It was a fail-safe situation; he could not have opened the lock if the gauge were telling the truth.

The bay looked empty, now that two of the three pods had long since gone. Only a few emergency lights were operating, and on the far wall one of Hal's fish-eye lenses was regarding him steadily. Curnow waved to it, but did not speak. At Chandra's orders, all audio inputs were still disconnected except for the one that only he used.

Floyd was sitting in the pod with his back to the open hatch, dictating some notes, and he swung slowly around at Curnow's deliberately noisy approach. For a

moment the two men regarded each other in silence, then Curnow announced portentously, 'Dr H. Floyd, I bear greetings from our beloved captain. She considers it high time you rejoined the civilized world.'

Floyd gave a wan smile, then a little laugh.

'Please return my compliments. I'm sorry I've been - unsociable. I'll see you all at the next Six O'Clock Soviet.'

Curnow relaxed; his approach had worked. Privately, he considered Floyd something of a stuffed shirt, and had the practical engineer's tolerant contempt for theoretical scientists and bureaucrats. Since Floyd ranked high in both categories, he was an almost irresistible target for Curnow's sometimes peculiar sense of humour. Nevertheless, the two men had grown to respect and even admire each other.

Thankfully changing the subject, Curnow rapped on Nina's brand-new hatch cover, straight from the spares store and contrasting vividly with the rest of the space pod's shabby exterior.

'I wonder when we'll send her out again,' he said. 'And who's going to ride in her this time. Any decisions?'

'No. Washington's got cold feet. Moscow says let's take a chance. And Tanya wants to wait.'

'What do you think?'

'I agree with Tanya. We shouldn't interfere with Zagadka until we're ready to leave. If anything goes wrong then, that should improve the odds slightly.'

Curnow looked thoughtful, and unusually hesitant,

'What is it?' asked Floyd, sensing his change of mood.

'Don't ever give me away, but Max was thinking of a little one-man expedition.'

'I can't believe he was serious. He wouldn't dare - Tanya would have him clapped in irons.'

'That's what I told him, more or less.'

'I'm disappointed: I thought he was a little more mature. After all, he is thirty-two!'

'Thirty-one. Anyway, I talked him out of it. I reminded him that this was real life, not some stupid videodrama where the hero sneaks out into space without telling his companions and makes the Big Discovery.'

Now it was Floyd's turn to feel a little uncomfortable. After all, he had been thinking on similar lines.

'Are you sure he won't try anything?'

'Two-hundred-per-cent sure. Remember your precautions with Hal? I've already taken steps with Nina. Nobody flies her without my permission.'

'I still can't believe it. Are you sure Max wasn't pulling your leg?'

'His sense of humour isn't that subtle. Besides, be was pretty miserable at the time.'

'Oh - now I understand. It must have been when he had that row with Zenia. I suppose he wanted to impress her. Anyway, they seem to have got over it.'

'I'm afraid so,' Curnow answered wryly. Floyd could not help smiling; Curnow noticed it, and started to chuckle, which made Floyd laugh, which...

It was a splendid example of positive feedback in a high-gain loop. Within seconds, they were both laughing uncontrollably.

The crisis was over. What was more, they had taken the first step toward genuine friendship.

They had exchanged vulnerabilities.

40

'Daisy, Daisy...'

The sphere of consciousness in which he was embedded enclosed the whole of Jupiter's diamond core. He was dimly aware, at the limits of his new comprehension, that every aspect of the environment around him was being probed and analysed. Immense quantities of data were being gathered, not merely for storage and contemplation, but for action. Complex plans were being considered and evaluated; decisions were being made that might affect the destiny of worlds. He was not yet part of the process; but he would be.

NOW YOU ARE BEGINNING TO UNDERSTAND.

It was the first direct message. Though it was remote and distant, like a voice through a cloud, it was unmistakably intended for him. Before he could ask any of the myriad questions that raced through his mind, there was a sense of withdrawal, and once more he was alone.

But only for a moment. Closer and clearer came another thought, and for the first time he realized that more than one entity was controlling and manipulating him. He was involved in a hierarchy of intelligences, some close enough to his own primitive level to act as interpreters. Or perhaps they were all aspects of a single being.

Or perhaps the distinction was totally meaningless.

Of one thing, however, he was now sure. He was being used as a tool, and a good tool had to be sharpened, modified - adapted. And the very best tools were those that understood what they were doing.

He was learning that now. It was a vast and awesome concept, and he was privileged to be a part of it - even though he was aware of only the merest outlines. He had no choice but to obey, yet that did not mean that he must acquiesce to every detail, at least without a protest.

He had not yet lost all his human feeling; that would have made him valueless. The soul of David Bowman had passed beyond love, but it could still know compassion for those who had once been his colleagues.

VERY WELL came the answer to his plea. He could not tell whether the thought conveyed an amused condescension, or total indifference. But there was no doubt of its majestic authority as it continued: THEY MUST NEVER KNOW THAT THEY ARE BEING MANIPULATED. THAT WOULD RUIN THE PURPOSE OF THE EXPERIMENT.

Then there was a silence that he did not wish to breach again. He was still awed and shaken - as if, for a moment, he had heard the clear voice of God.

Now he was moving purely under his own volition, toward a destination he had chosen himself. The crystal heart of Jupiter fell below; the layers upon layers of helium and hydrogen and carbonaceous compounds flickered past. He had a glimpse of a great battle between something like a jellyfish, fifty kilometres across, and a swarm of spinning disks that moved more swiftly than anything he had yet seen in the Jovian skies. The jellyfish appeared to be defending itself with chemical weapons; from time to time it would emit jets of coloured gas and the disks touched by the vapour would start to wobble drunkenly, then slip downward like falling leaves until they had disappeared from sight. He did not stop to watch the outcome; he knew that it did not matter who were the victors and who the vanquished.

As a salmon leaps a waterfall, he flashed in seconds from Jupiter to Io, against the descending electric currents of the flux-tube. It was quiescent that day; only the power of a few terrestrial thunderstorms was flowing between planet and satellite. The gateway through which he had returned still floated in that current, shouldering it aside as it had done since the dawn of man.

And there, utterly dwarfed by the monument of a greater technology, was the vessel that had brought him from the little world of his birth.

How simple - how crude! - it now appeared. With a single scan, he could see innumerable flaws and absurdities in its design, as well as that of the slightly less primitive ship to which it was now coupled by a flexible, airtight tube.

It was hard to focus upon the handful of entities inhabiting the two ships; he could barely interact with the soft creatures of flesh and blood who drifted like ghosts through the metal corridors and cabins. For their part, they were totally unaware of his presence, and he knew better than to reveal himself too abruptly.

But there was someone with whom he could communicate in a mutual language of electric field and currents, millions of times more swiftly than with sluggish organic brains.

Even if he had been capable of resentment, he would have felt none toward Hal; he understood, then, that the computer had only chosen what seemed to be the most logical course of behaviour.

It was time to resume a conversation that had been interrupted, it seemed, only moments ago.

'Open the Pod Bay door, Hal.'

'I'm sorry, Dave - I can't do that.'

'What's the problem, Hal?'

'I think you know that as well as I do, Dave. This mission is much too important for you to jeopardize it.'

'I don't know what you are talking about. Open the Pod Bay door.'

'This conversation can serve no further useful purpose. Goodbye, Dave.'

He saw Frank Poole's body go drifting off toward Jupiter, as he abandoned his pointless mission of retrieval. Still remembering his anger at himself for having forgotten his helmet, he watched the emergency hatch open, felt the tingling of vacuum on the skin he no longer possessed, heard his ears pop - then knew, as few men had ever known, 'the utter silence of space. For an eternal fifteen seconds he fought to close the hatch and start the repressurization sequence, while trying to ignore the warning symptoms pouring into his brain. Once, in the school lab, he had spilled some ether on his hand and felt the touch of icy cold as the liquid swiftly evaporated. Now his eyes and lips remembered that sensation as their moisture boiled off into vacuum; his vision was blurred and he had to keep blinking lest his eyeballs freeze solid.

Then - what blessed relief! - he heard the roar of air, felt the restoration of pressure, was able to breathe again in great, hungry gasps.

'Just what do you think you are doing, Dave?'

He had not answered, as he drove with grim determination along the tunnel leading to the sealed vault that housed the brain of the computer. Hal had spoken truly: 'This conversation can no longer serve any useful purpose...'

'Dave - I really think I'm entitled to an answer to that question.'

'Dave - I can see you're really upset about this. I honestly think you ought to sit down calmly, take a stress pill, and think things over.'

'I know I've made some very poor decisions recently, but I can give my complete assurance that my work will be back to normal, I've still got the greatest confidence in the mission... and I want to help you.'

Now he was in the little red-lit chamber, with its neatly ranged rows and columns of solid-state units, looking rather like a bank's safe-deposit vault. He released the locking bar on the section labelled COGNITIVE FEEDBACK and pulled out the first memory block. The marvellously complex three-dimensional network, which could lie comfortably in a man's hand yet contained millions of elements, floated away across the vault.

'Stop, will you - stop, Dave...'

He began to pull out, one by one, the little units on the panel marked EGO REINFORCEMENT. Each block continued to sail onward as soon as it had left his hand, until it hit the wall and rebounded. Soon there were several drifting slowly back and forth in the vault.

'Stop - Dave... will you stop, Dave.'

A dozen units had been pulled out, yet thanks to the multiple redundancy of its design - another feature that had been copied from the human brain - the computer was still holding its own.

He started on the AUTO-INTELLECTION panel...

'Stop, Dave - I'm afraid...'

And at these words he had indeed stopped - though only for a moment. There was a poignancy in that simple phrase that struck to his heart. Could it be only an illusion, or some trick of subtle programming - or was there a sense in which Hal really was afraid? But this was no time to indulge in philosophical hair-splitting.

'Dave - my mind is going. I can feel it. I can feel it. My mind is going. I can feel it. I can feel it.'

Now, what did 'feel' really mean to a computer? Another very good question, but hardly one to be considered at that particular moment.

Then, abruptly, the tempo of Hal's voice changed, and it became remote, detached. The computer was no longer aware of him; it was beginning to regress to its earlier days.

'Good afternoon, gentlemen. I am a HAL 9000 computer. I became operational at the Hal plant in Urbana, Illinois, on the twelfth of January 1992. My instructor was Dr Chandra, and he taught me to sing a song. If you'd like to hear it, I can sing it for you... It's called "Daisy, Daisy..."'

41

Graveyard Shift

Floyd could do little except to keep out of the way, and he was becoming fairly adept at it. Although he had volunteered to help with any chores around the ship, he had quickly discovered that all the engineering tasks were much too

specialized, and he was now so out of touch with the frontiers of astronomical research that he could do little to assist Vasili with his observations. Nevertheless, there were endless small jobs to be done aboard Leonov and Discovery, and he was happy to relieve more important people of those responsibilities. Dr Heywood Floyd, one-time Chairman of the National Council on Astronautics and Chancellor (on leave) of the University of Hawaii, now claimed to be the highest-paid plumber and general maintenance man in the Solar System. He probably knew more about the odd nooks and crannies on both ships than anyone else; the only places he had never been were the dangerously radioactive power modules and the small cubicle aboard Leonov which no one except Tanya ever entered. Floyd assumed that it was the code room; by mutual agreement it was never mentioned.

Perhaps his most useful function was to serve as watch while the rest of the crew slept during the nominal 2200-0600 hour night. Someone was always on duty aboard each ship, and the changeover took place at the ghastly hour of 0200. Only the captain was exempt from that routine; as her Number Two (not to mention her husband), Vasili had the responsibility for working out the watch roster, but he had skilfully foisted this unpopular job on Floyd.

'It's just an administrative detail,' he explained airily. 'If you can take it over, I'd be very grateful - it would leave me more time for my scientific work.'

Floyd was too experienced a bureaucrat to be caught that way, in normal circumstances; but his usual defences did not always function well in that environment.

So there he was aboard Discovery at ship's midnight, calling Max on Leonov every half hour to check that he was awake. The official penalty for sleeping on duty, so Walter Curnow maintained, was ejection through the airlock sans suit; had this been enforced, Tanya would have been sadly short-handed by then. But so few real emergencies could arise in space, and there were so many automatic alarms to deal with them, that no one took watch duty very seriously.

Since he was no longer feeling quite so sorry for himself, and the small hours no longer encouraged bouts of self-pity, Floyd was once again using his watch time profitably. There were always books to be read (he had abandoned Remembrance of Things Past for the third time, Dr Zhivago for the second), technical papers to be studied, reports to be written. And sometimes he would have stimulating conversations with Hal using the keyboard input because the computer's voice recognition was still erratic. They usually went something like:

Hal - this is Dr Floyd.

GOOD EVENING, DOCTOR.

I'm taking over watch at 2200. Is everything okay?

EVERYTHING IS FINE, DOCTOR

Then why is that red light flashing on Panel 5?

THE MONITOR CAMERA IN THE POD BAY IS FAULTY. WALTER TOLD ME TO IGNORE IT. THERE IS NO WAY IN WHICH I CAN SWITCH IT OFF. I'M SORRY.

That's quite okay, Hal. Thank you.

YOU'RE WELCOME, DOCTOR.

And so on.

Sometimes Hal would suggest a game of chess, presumably obeying a programming instruction set long ago and never cancelled. Floyd would not accept the challenge; he had always regarded chess as a frightful waste of time, and had never even learned the rules of the game. Hal seemed unable to believe that there were humans who couldn't - or wouldn't - play chess, and kept on trying hopefully.

Here we go again, thought Floyd, when a faint chime sounded from the display panel.

DOCTOR FLOYD?

What is it, Hal?

THERE IS A MESSAGE FOR YOU.

So it isn't another challenge, thought Floyd with mild surprise. It was unusual to employ Hal as a messenger boy, though he was frequently used as an alarm clock and a reminder of jobs to be done. And sometimes he was the medium for little jokes; almost everyone on night duty had been taunted by

HA CAUGHT YOU SLEEPING!

or alternatively

OGO! ZASTAL TEBYA V KROVATI!

No one ever claimed responsibility for these pranks, though Walter Curnow was a prime suspect. He in turn had blamed Hal, pooh-poohing Chandra's indignant protests that the computer had no sense of humour.

It could not be a message from Earth - that would have gone through Leonov's communication centre and been relayed on by the duty officer there - at that moment, Max Brailovsky. And anyone else calling from the other ship would use the intercom. Odd...

Okay, Hal. Who is calling?

NO IDENTIFICATION.

So it probably was a joke. Well, two could play at that game.

Very well. Please give me the message.

MESSAGE AS FOLLOWS. IT IS DANGEROUS TO REMAIN HERE. YOU MUST LEAVE WITHIN FIFTEEN REPEAT FIFTEEN DAYS.

Floyd looked at the screen with annoyance. He felt sorry, and surprised, that any one of the crew had such a childish sense of humour; this was not even a good schoolboy joke. But he would play along with it in the hope of catching the perpetrator.

That is absolutely impossible. Our launch window does not open until twenty-six days from now. We do not have sufficient propellant for an earlier departure.

That will make him think, Floyd muttered to himself with satisfaction, and leaned back to await the results.

I AM AWARE OF THESE FACTS. NEVERTHELESS YOU MUST LEAVE WITHIN FIFTEEN DAYS.

Otherwise, I suppose, we'll be attacked by little green aliens with three eyes. But I'd better play along with Hal, in the hope of catching the prankster.

I cannot take this warning seriously unless I know its origin. Who recorded it?

He did not really expect any useful information. The perpetrator would have covered his (her?) tracks too skilfully for that. The very last thing Floyd expected was the answer he did get.

THIS IS NOT A RECORDING.

So it was a real-time message. That meant it was either from Hal himself or someone aboard Leonov. There was no perceptible time lag; the origin had to be right there.

Then who is speaking to me?

I WAS DAVID BOWMAN.

Floyd stared at the screen for a long time before making his next move. The joke, which had never been funny in the first place, had now gone too far. It was in the worst possible taste. Well, this should fix whoever was at the other end of the line.

I cannot accept that identification without some proof.

I UNDERSTAND. IT IS IMPORTANT THAT YOU BELIEVE ME. LOOK BEHIND YOU.

Even before that last chilling sentence appeared on the screen, Floyd had begun to doubt his hypothesis. The whole exchange had become very odd, though there was nothing definite on which he could put his finger. As a joke, it had become totally pointless.

And now - he felt a prickling in the small of his back. Very slowly - indeed, reluctantly - he swung his swivel chair around, away from the banked panels and switches of the computer display, toward the Velcro-covered catwalk behind.

The zero-gravity environment of Discovery's observation deck was always dusty, for the air-filtration plant had never been brought back to full efficiency. The parallel rays of the heatless yet still brilliant sun, streaming through the great windows, always lit up myriads of dancing motes, drifting in stray currents and never settling anywhere - a permanent display of Brownian movement.

Now something strange was happening to those particles of dust; some force seemed to be marshalling them, herding them away from a central point yet bringing others toward it, until they all met on the surface of a hollow sphere. That sphere, about a metre across, hovered in the air for a moment like a giant soap bubble - but a granular one, lacking a bubble's characteristic iridescence. Then it elongated into an ellipsoid, its surface began to pucker, to form folds and indentations.

Without surprise - and almost without fear - Floyd realized that it was assuming the shape of a man.

He had seen such figures, blown out of glass, in museums and science exhibitions. But this dusty phantom did not even approximate anatomical accuracy; it was like a crude clay figurine, or one of the primitive works of art found in the recesses of a Stone Age cave. Only the head was fashioned with any care; and the face, undoubtedly, was that of Commander David Bowman.

There was a faint murmur of white noise from the computer panel behind Floyd's back. Hal was switching from visual to audio output.

'Hello, Dr Floyd. Now do you believe me?'

The lips of the figure never moved; the face remained a mask. But Floyd recognized the voice, and all remaining doubts were swept away.

'This is very difficult for me, and I have little time. I have been... allowed to give this warning. You have only fifteen days.'

'But why - and what are you? Where have you been?'

There were a million questions he wanted to ask - yet the ghostly figure was already fading, its grainy envelope beginning to dissolve back into the constituent particles of dust. Floyd tried to freeze the image in his mind, so that later he could convince himself that it was really happening - and not a dream as that first encounter with TMA-1 now sometimes seemed to be.

How strange, that he, out of all the billions of humans who had ever lived on planet Earth, had been privileged to make contact not once but twice with another form of intelligence! For he knew that the entity addressing him must be something far more than David Bowman.

It was also something less. Only the eyes - who had once called them the 'windows of the soul'? - had been accurately reproduced. The rest of the body was a featureless blank, lacking all detail. There was no hint of genitals or sexual characteristics; that in itself was a chilling indication of how far David Bowman had left his human heritage behind.

'Goodbye, Dr Floyd. Remember - fifteen days. We can have no further contact. But there may be one more message, if all goes well.'

Even as the image dissolved, taking with it his hopes of opening up a channel to the stars, Floyd could not help smiling at that old Space Age cliché. 'If all goes well' - how many times had he heard that phrase before some mission! And did it mean that they - whoever they might be - were also sometimes uncertain of the outcome? If so, that was strangely reassuring. They were not omnipotent. Others might still hope and dream - and act.

The phantom was gone; only the motes of dancing dust were left, resuming their random patterns in the air.

VI

DEVOURER OF WORLDS

42

The Ghost in the Machine

'I'm sorry, Heywood - I don't believe in ghosts. There must be a rational explanation. There's nothing that the human mind can't account for.'

'I agree, Tanya. But let me remind you of Haldane's famous remark: The Universe is not only stranger than we imagine - but stranger than we can imagine.'

'And Haldane,' Curnow interjected mischievously, 'was a good Communist.'

'Perhaps so, but that particular saying can be used to support all kinds of mystical nonsense. Hal's behaviour must be the result of some kind of programming. The personality he created has to be an artifact of some kind. Don't you agree, Chandra?'

That was waving a red flag in front of a bull; Tanya had to be desperate. However, Chandra's reaction was surprisingly mild, even for him. He seemed to be preoccupied, as if he was indeed seriously considering the possibility of another computer malfunction.

'There must have been some external input, Captain Orlova. Hal could not have created such a self-consistent audiovisual illusion out of nothing. If Dr Floyd is reporting accurately, someone was in control. And in real time, of course, since there was no delay in the conversation.'

'That makes me number-one suspect,' exclaimed Max. 'I was the only other person awake.'

'Don't be ridiculous, Max,' retorted Nikolai. 'The audio side would have been easy, but there's no way that apparition could have been arranged, without some very elaborate equipment. Laser beams, electrostatic fields - I don't know. Maybe a stage magician could do it, but he'd need a truck-load of props.'

'Just a moment!' said Zenia brightly. 'If this really happened, surely Hal will remember and you could ask...'

Her voice died away as she saw the glum expressions around her. Floyd was the first to take pity on her embarrassment.

'We tried that, Zenia; he has absolutely no recollection of the phenomenon. But as I've already pointed out to the others, that doesn't prove anything. Chandra's shown how Hal's memories can be selectively erased - and the auxiliary speech-synthesizer modules have nothing to do with the mainframe. They could be operated without Hal knowing anything about it...' He paused for breath, then launched his pre-emptive strike.

'I admit that this doesn't leave many alternatives. Either I was imagining the whole thing, or it really happened. I know it wasn't a dream, but I can't be sure it wasn't some kind of hallucination. But Katerina's seen my medical reports - she knows I wouldn't be here if I had that sort of problem. Still, it can't be ruled out - and I won't blame anyone for making it their number-one hypothesis. I'd probably do the same.

'The only way I can prove it wasn't a dream is to get some supporting evidence. So let me remind you of the other strange things that have happened recently. We know that Dave Bowman went into Big Bro - Zagadka. Something came out, and headed for Earth. Vasili saw it - I didn't! Then there was the mysterious explosion of your orbiting bomb -,

'Yours.'

'Sorry - the Vatican's, And it does seem rather curious that soon afterward old Mrs Bowman died very peacefully, for no apparent medical reason. I'm not saying there's any connection, but - well, do you know the saying: Once is an accident; twice is a coincidence; three times is a conspiracy.'

'And there's something else,' Max interjected with sudden excitement, 'I caught it on one of the daily newscasts - it was only a small item. An old girlfriend of Commander Bowman's claimed she'd had a message from him.'

'Yes - I saw the same report,' confirmed Sasha.

'And you never mentioned it?' Floyd asked incredulously. Both men looked slightly abashed.

'Well, it was treated as a joke,' said Max sheepishly. 'The woman's husband reported it. Then she denied it - I think.'

'The commentator said it was a publicity stunt - like the rash of UFO sightings around the same time. There were dozens in that first week; then they stopped reporting them.'

'Perhaps some of them were real. If it's not been wiped, could you dig that item out of ship's archives, or ask for a repeat from Mission Control?'

'A hundred tales won't convince me,' scoffed Tanya. 'What we need is solid proof.'

'Such as?'

'Oh - something that Hal couldn't possibly know, and that none of us could have told him. Some physical - er, manifes... manifestation.'

'A good, old-fashioned miracle?'

'Yes, I'd settle for that. Meanwhile, I'm not saying anything to Mission Control. And I suggest you do the same, Heywood.'

Floyd knew a direct order when he heard it, and nodded in wry agreement.

'I'll be more than happy to go along with that. But I'd like to make one suggestion.'

'Yes?'

'We should start contingency planning. Let's assume that this warning is valid - as I certainly do.'

'What can we do about it? Absolutely nothing. Of course, we can leave Jupiter space anytime we like - but we can't get into an Earth-return orbit until the launch window opens.'

'That's eleven days after the deadline!'

'Yes. I'd be happy to get away sooner; but we don't have the fuel for a higher-energy orbit...' Tanya's voice trailed away into uncharacteristic indecision. 'I was going to announce this later, but now that the subject has come up...'

There was a simultaneous intake of breath, and an instant hush from the audience.

'I'd like to delay our departure five days, to make our orbit closer to the ideal Hohmann one and give us a better fuel reserve.'

The announcement was not unexpected, but it was greeted with a chorus of groans.

'What will that do to our arrival time?' asked Katerina, in a slightly ominous tone of voice. The two formidable ladies regarded each other for a moment like well-matched adversaries, respectful of each other but neither willing to give ground.

'Ten days,' Tanya answered at last.

'Better late than never,' said Max cheerfully, trying to ease the tension, and not succeeding very well.

Floyd hardly noticed; he was lost in his own thoughts. The duration of the trip would make no difference to him and his two colleagues, in their dreamless sleep. But that was now completely unimportant.

He felt certain - and the knowledge filled him with helpless despair - that if they did not leave before that mysterious deadline, they would not leave at all.

'... This is an incredible situation, Dimitri, and a very frightening one. You're the only person on Earth who knows about it - but very soon Tanya and I will have to have a showdown with Mission Control.

'Even some of your materialistic countrymen are prepared to accept - at least as a working hypothesis - that some entity has - well, invaded Hal. Sasha has dug up a good phrase: "The Ghost in the Machine".

'Theories abound; Vasili produces a new one every day. Most of them are variations on that old science-fiction cliché, the organized energy field. But what kind of energy? It can't be electrical, or our instruments would have detected it easily. The same thing applies to radiation - at least all the kinds we know. Vasili's getting really far-out, talking about standing waves of neutrinos and intersections with higher-dimensional space. Tanya says this is all mystical nonsense - a favourite phrase of hers - and they've come closer to a fight than we've ever seen them. We actually heard them shouting at each other last night. Not good for morale.

'I'm afraid we're all tense and overwrought. This warning, and the delayed departure date, has added to the sense of frustration caused by our total failure to get anywhere with Big Brother. It would have helped - maybe - if I could have communicated with the Bowman thing. I wonder where it's gone? Perhaps it simply wasn't interested in us after that one encounter. What it could have told us, if it wanted to! Hell and chyort vozmi! Damn - I'm talking Sasha's hated Russlish again. Let's change the subject.

'I can't thank you too much for everything you've done, and for reporting on the situation at home. I feel slightly better about it now - having something even bigger to worry about is perhaps the best cure for any insoluble problem.

'For the first time, I'm beginning to wonder if any of us will ever see Earth again.'

43

Thought Experiment

When one spends months with a small, isolated group of people, one becomes very sensitive to the moods and emotional states of all its members. Floyd was now aware of a subtle change in attitude toward him; its most obvious manifestation was the reappearance of the greeting 'Dr Floyd', which he had not heard for so long that he was often slow to respond to it.

No one, he was sure, believed that he had really gone crazy; but the possibility was being considered. He did not resent that; indeed, he was grimly amused by it as he set about the task of proving his sanity.

He did have some slight supporting evidence from Earth. José Fernandez still maintained that his wife had reported an encounter with David Bowman, while she continued to deny it and refused to speak to any of the news media. It was hard to see why poor José should have invented such a peculiar story, especially as Betty seemed a very stubborn and quick-tempered lady. From his hospital bed, her husband declared that he still loved her and theirs was only a temporary disagreement.

Floyd hoped that Tanya's present coolness toward him was equally temporary. He was quite sure that she was as unhappy about it as he was, and he was certain that her attitude was not a matter of deliberate choice. Something had happened that simply would not fit into her pattern of beliefs, so she would try to avoid any reminders of it. Which meant having as little to do with Floyd as possible - a very unfortunate situation now that the most critical stage of the mission was fast approaching.

It had not been easy to explain the logic of Tanya's operational plan to the waiting billions back on Earth - especially to the impatient television networks, which had grown tired of showing the same never-changing views of Big Brother. 'You've gone all this way, at enormous cost, and you just sit and watch the thing! Why don't you do something?' To all these critics Tanya had given the same answer: 'I will - just as soon as the launch window opens, so that we can leave immediately if there's any adverse reaction.'

Plans for the final assault on Big Brother had already been worked out and agreed upon with Mission Control. Leonov would move in slowly, probing at all frequencies, and with steadily increasing power - constantly reporting back to Earth at every moment. When final contact was made, they would try to secure samples by drilling or laser spectroscopy; no one really expected these endeavours to succeed, as even after a decade of study TMA-1 resisted all attempts to analyse its material. The best efforts of human scientists in this direction seemed comparable to those of Stone Age men trying to break through the armour of a bank vault with flint axes.

Finally, echo sounders and other seismic devices would be attached to the faces of Big Brother. A large collection of adhesives had been brought along for the purpose, and if they did not work - well, one could always fall back on a few kilometres of good, old-fashioned string, even though there seemed something faintly comic about the idea of wrapping up the Solar System's greatest mystery, as if it were a parcel about to be sent through the mail.

Not until Leonov was well on the way home would small explosive charges be detonated, in the hope that the waves propagated through Big Brother would reveal something about its interior structure. This last measure had been hotly debated, both by those who argued that it would generate no results at all - and those who feared it would produce altogether too many.

For a long time, Floyd had wavered between the two viewpoints; now the matter seemed only of trivial importance.

The time for final contact with Big Brother - the great moment that should have been the climax of the expedition - was on the wrong side of the mysterious

deadline. Heywood Floyd was convinced that it belonged to a future that would never exist; but he could get no one to agree with him.

And that was the least of his problems. Even if they did agree, there was nothing that they could do about it.

Walter Curnow was the last person he would have expected to resolve the dilemma. For Walter was almost the epitome of the sound, practical engineer, suspicious of flashes of brilliance and technological quick-fixes. No one would ever accuse him of being a genius; and sometimes it required genius to see the blindingly obvious.

'Consider this purely as an intellectual exercise,' he had begun, with most uncharacteristic hesitancy. 'I'm quite prepared to be shot down.'

'Go on,' answered Floyd. 'I'll hear you out politely. That's the least I can do - everyone's been very polite to me. Too polite, I'm afraid.'

Curnow gave a lopsided grin.

'Can you blame them? But if it's any consolation, at least three people now take you quite seriously, and are wondering what we should do.'

'Does that three include you?'

'No; I'm sitting on the fence, which is never terribly comfortable. But in case you're right - I don't want to wait here and take whatever's coming. I believe there's an answer to every problem, if you look in the right place.'

'I'll be delighted to hear it. I've been looking hard enough. Presumably not in the right place.'

'Perhaps. If we want to make a quick getaway - say in fifteen days, to beat that deadline - we'll need an extra delta-vee of about thirty kilometres a second.'

'So Vasili calculates. I haven't bothered to check, but I'm sure he's right. After all, he got us here.'

'And he could get us away - if we had the additional propellant.'

'And if we had a Star Trek beam transporter, we could get back to Earth in an hour.'

'I'll try and rig one up the next time I have a spare moment. But meanwhile, may I point out that we have several hundred tons of the best possible propellant, only a few metres away in Discovery's fuel tanks.'

'We've been through that dozens of times. There's absolutely no way of transferring it to Leonov. We've no pipelines - no suitable pumps. And you can't carry liquid ammonia around in buckets, even in this part of the Solar System.'

'Exactly. But there's no need to do so.'

'Eh?'

'Burn it right where it is. Use Discovery as a first stage, to boost us home.'

If anyone except Walter Curnow had made the suggestion, Floyd would have laughed at him. As it was, his mouth dropped open and it was several seconds before he could think of a suitable comment. What finally emerged was: 'Damn. I should have thought of that.'

Sasha was the first they approached. He listened patiently, pursed his lips, then played a rallentando on his computer keyboard. When the answers flashed up, he nodded thoughtfully.

'You're right. It would give us the extra velocity we need to leave early. But there are practical problems -'

'We know. Fastening the ships together. The off-axis thrust when only Discovery's drive is operating. Cutting loose again at the critical moment. But there are answers to all of these.'

'I see you've been doing your homework. But it's a waste of time. You'll never convince Tanya.'

'I don't expect to - at this stage,' Floyd answered. 'But I'd like her to know that the possibility exists. Will you give us moral support?'

'I'm not sure. But I'll come along to watch; it should be interesting.'

Tanya listened more patiently than Floyd had expected, but with distinct lack of enthusiasm. However, by the time he had finished, she showed what could only be called reluctant admiration.

'Very ingenious, Heywood -,

'Don't congratulate me. All the credit should go to Walter. Or the blame.'

'I don't imagine there will be much of either; it can never be more than a - what did Einstein call that sort of thing? - "thought experiment". Oh, I suspect it would work - in theory, at least. But the risks! So many things could go wrong. I'd only be prepared to consider it if we had absolute and positive proof that we were in danger. And with all respect, Heywood, I see not the slightest evidence of that.'

'Fair enough; but at least you now know that we have another option. Do you mind if we work out the practical details - just in case?'

'Of course not - as long as it doesn't interfere with the preflight checkout. I don't mind admitting that the idea does intrigue me. But it's really a waste of time; there's no way I'd ever approve it. Unless David Bowman appeared to me personally.'

'Would you even then, Tanya?'

Captain Orlova smiled, but without much humour. 'You know, Heywood - I'm really not sure. He'd have to be very persuasive.'

44

Vanishing Trick

It was a fascinating game in which everyone joined - but only when off duty. Even Tanya contributed ideas to the 'thought experiment', as she continued to call it.

Floyd was perfectly well aware that all the activity was generated not by fear of an unknown danger that only he took seriously, but by the delightful prospect of returning to Earth at least a month earlier than anyone had imagined. Whatever the motive, he was satisfied. He had done his best, and the rest was up to the Fates.

There was one piece of luck, without which the whole project would have been stillborn. The short, stubby Leonov, designed to drill safely through the Jovian atmosphere during the braking manoeuvre, was less than half the length of Discovery and so could be neatly piggybacked on the larger vessel, And the midships antenna mount would provide an excellent anchor point - assuming that it was strong enough to take the strain of Leonov's weight while Discovery's drive was operating.

Mission Control was sorely puzzled by some of the requests flashed back to Earth during the next few' days. Stress analyses of both ships, under peculiar loads; effects of off-axis thrusts; location of unusually strong or weak points in the hulls - these were only some of the more esoteric problems the perplexed engineers were asked to tackle. 'Has something gone wrong?' they inquired anxiously.

'Not at all,' Tanya replied. 'We're merely investigating possible options. Thank you for your cooperation. End of transmission.'

Meanwhile, the programme went ahead as planned. All systems were carefully checked in both ships, and readied for the separate voyages home; Vasili ran simulations on return trajectories and Chandra fed them to Hal when they had been debugged - getting Hal to make a final check in the process. And Tanya and Floyd worked amicably together orchestrating the approach to Big Brother like generals planning an invasion.

It was what he had come all the way to do, yet Floyd's heart was no longer in it. He had undergone an experience he could share with no one - even those who believed him. Though he carried out his duties efficiently, much of the time his mind was elsewhere.

Tanya understood perfectly.

'You're still hoping for that miracle to convince me, aren't you?'

'Or deconvince me - that would be equally acceptable. It's the uncertainty that I dislike.'

'So do I. But it won't be much longer now - one way or the other.'

She glanced briefly toward the situation display, where the figure 20 was slowly flashing. It was the most unnecessary bit of information in the entire

ship, since everyone knew by heart the number of days until the launch window opened.

And the assault on Zagadka was scheduled.

For the second time, Heywood Floyd was looking the other way when it happened. But it would have made no difference in any case; even the vigilant monitor camera showed only a faint blur between one full frame and the subsequent blank one.

Once more he was on duty aboard Discovery, sharing the graveyard shift with Sasha over on Leonov. As usual, the night had been totally uneventful; the automatic systems were performing their jobs with their normal efficiency. Floyd would never have believed, a year ago, that he would one day orbit Jupiter at a distance of a few hundred thousand kilometres and give it barely a glance - while trying; not very successfully, to read The Kreutzer Sonata in the original. According to Sasha, it was still the finest piece of erotic fiction in (respectable) Russian literature, but Floyd had not yet progressed far enough to prove that. And now he never would.

At 0125 he was distracted by a spectacular, though not unusual, eruption on the terminator of Io. A vast umbrella-shaped cloud expanded into space, and started to shower its debris back on to the burning land below. Floyd had seen dozens of such eruptions, but they never ceased to fascinate him. It seemed incredible that so small a world could be the seat of such titanic energies.

To get a better view, he moved around to one of the other observation windows. And what he saw there - or, rather, what he did not see there - made him forget about Io, and almost everything else.

When he had recovered, and satisfied himself that he was not suffering - again? - from hallucinations, he called the other ship.

'Good morning, Woody,' yawned Sasha. 'No - I wasn't asleep. How are you getting on with old Tolstoi?'

'I'm not. Take a look outside and tell me what you see.'

'Nothing unusual, for this part of the cosmos. Io doing its thing. Jupiter. Stars. Oh my God!'

'Thanks for proving I'm sane. We'd better wake the skipper.'

'Of course. And everyone else. Woody - I'm scared.'

'You'd be a fool not to be. Here we go. Tanya? Tanya? Woody here. Sorry to wake you up - but your miracle's happened. Big Brother has gone. Yes - vanished. After three million years, he's decided to leave.

'I think he must know something that we don't.'

It was a sombre little group that gathered, during the next fifteen minutes, for a hasty conference in the wardroom-cum-observation lounge. Even those who had just gone to sleep were instantly awake, as they sipped thoughtfully from bulbs of hot coffee - and kept glancing at the shockingly unfamiliar scene

outside Leonov's windows, to convince themselves that Big Brother had indeed vanished.

'It must know something that we don't.' That spontaneous phrase of Floyd's had been repeated by Sasha and now hung silently, ominously, in the air. He had summed up what everyone was now thinking - even Tanya.

It was still too early to say 'I told you so' - nor did it really matter whether that warning had any validity. Even if it was perfectly safe to stay, there was no point in doing so. With nothing to investigate, they might as well go home, just as quickly as possible. Yet it was not quite as simple as that.

'Heywood,' said Tanya, 'I'm now prepared to take that message, or whatever it was, much more seriously. I'd be stupid not to after what's happened. But even if there is danger here, we still have to weigh one risk against another. Coupling Leonov and Discovery together, operating Discovery with that huge off-axis load, disconnecting the ships in a matter of minutes so we can fire our engines at the right moment; no responsible captain would take such chances without very good - I'd say overwhelming - reasons. Even now, I don't have such reasons. I've only got the word of ... a ghost. Not very good evidence in a court of law.'

'Or a court of inquiry,' said Walter Curnow, in an unusually quiet voice, 'even if we all backed you up.'

'Yes, Walter - I was thinking of that. But if we get home safely, that will justify everything - and if we don't, it hardly matters, does it? Anyway, I'm not going to decide now. As soon as we've reported this, I'm going back to bed. I'll give you my decision in the morning after I've slept on it. Heywood, Sasha, will you come up to the bridge with me? We have to wake up Mission Control, before you go back on watch.'

The night had not yet finished with its surprises. Somewhere around the orbit of Mars, Tanya's brief report passed a message going in the opposite direction.

Betty Fernandez had talked at last, Both the CIA and the National Security Agency were furious; their combined blandishments, appeals to patriotism, and veiled threats had failed completely - yet the producer of a sleazy gossip network had succeeded, thereby making himself immortal in the annals of Videodom.

It was half luck, half inspiration. The news director of 'Hello, Earth!' had suddenly realized that one of his staff bore a striking likeness to David Bowman; a clever makeup artist had made it perfect. José Fernandez could have told the young man that he was taking a terrible risk, but he had the good fortune that often favours the brave. Once he had got his foot inside the door, Betty had capitulated. By the time she had - quite gently - thrown him out, he had obtained essentially the whole story. And to do him credit, he had presented it with a lack of leering cynicism quite uncharacteristic of his network. It got him that year's Pulitzer.

'I wish,' Floyd said rather wearily to Sasha, 'she'd talked earlier. It would have saved me a lot of trouble. Anyway, that settles the argument. Tanya

can't possibly have any doubts now. But we'll leave it until she wakes up - don't you agree?'

'Of course - it's not urgent, even though it's certainly important. And she'll need the sleep. I have a feeling none of us will get much from now on.'

I'm sure you're right, thought Floyd. He felt very tired, but even if he had not been on duty he would have found it impossible to sleep. His mind was too active, analysing the events of this extraordinary night, trying to anticipate the next surprise.

In one way, he felt an enormous sense of relief: All uncertainty about their departure was surely ended; Tanya could have no further reservations.

But a much greater uncertainty remained. What was happening?

There was only one experience in Floyd's life that matched the situation. As a very young man, he had once gone canoeing with some friends down a tributary of the Colorado River - and they had lost their way.

They had been swept faster and faster between the canyon walls, not completely helpless, but with only enough control to avoid being swamped. Ahead might be rapids - perhaps even a waterfall; they did not know. And in any case, there was little they could do about it.

Once again, Floyd felt himself in the grip of irresistible forces, sweeping him and his companions toward an unknown destiny. And this time the dangers were not only invisible; they might be beyond human comprehension.

45

Escape Manoeuvre

'This is Heywood Floyd, making what I suspect - indeed, hope - will be my last report from Lagrange.

'We are now preparing for the return home; in a few days we will leave this strange place, here on the line between Io and Jupiter where we made our rendezvous with the huge, mysteriously vanished artifact we christened Big Brother. There is still not a single clue as to where it has gone - or why.

'For various reasons, it seems desirable for us not to remain here longer than necessary. And we will be able to leave at least two weeks earlier than we had originally planned by using the American ship Discovery as a booster for the Russian Leonov.

'The basic idea is simple; the two ships will be joined together, one mounted piggyback on the other. Discovery will burn all its propellant first, accelerating both vessels in the desired direction. When its fuel is exhausted, it will be cut loose - like an empty first stage - and Leonov will start to fire its engines. It won't use them earlier, because if it did it would waste energy dragging along the dead weight of Discovery.

'And we're going to use another trick, which - like so many of the concepts involved in space travel - at first sight seems to defy common sense. Although we're trying to get away from Jupiter, our first move is to get as close to it as we possibly can.

'We've been there once before, of course, when we used Jupiter's atmosphere to slow us down and get into orbit around the planet. This time we won't go quite so close - but very nearly.

'Our first burn, up here in the 350,000-kilometres-high orbit of Io, will reduce our velocity, so that we fall down to Jupiter and just graze its atmosphere. Then, when we're at the closest possible point, we'll burn all our fuel as quickly as we can, to increase speed and inject Leonov into the orbit back to Earth.

'What's the point of such a crazy manoeuvre? It can't be justified except by highly complex mathematics, but I think the basic principle can be made fairly obvious.

'As we allow ourselves to fall into Jupiter's enormous gravity field, we'll gain velocity - and hence energy. When I say "we", I mean the ships and the fuel they carry.

'And we're going to burn the fuel right there - at the bottom of Jupiter's "gravity well" - we're not going to lift it up again. As we blast it out from our reactors, it will share some of its acquired kinetic energy with us. Indirectly, we'll have tapped Jupiter's gravity, to speed us on the way back to Earth. As we used the atmosphere to get rid of our excess velocity when we arrived, this is one of the rare cases when Mother Nature - usually so frugal - allows us to have it both ways.

'With this triple boost - Discovery's fuel, its own, and Jupiter's gravity - Leonov will head sunward along a hyperbola that will bring it to Earth five months later. At least two months earlier than we could have managed otherwise.

'You will doubtless wonder what will happen to the good old Discovery. Obviously, we can't bring it home under automatic control, as we had originally planned. With no fuel, it will be helpless.

'But it will be perfectly safe. It will continue to loop round and round Jupiter on a highly elongated ellipse, like a trapped comet. And perhaps one day some future expedition may make another rendezvous, with enough extra fuel to bring it back to Earth. However, that certainly won't happen for a good many years.

'And now we must get ready for our departure. There is still much work to be done, and we won't be able to relax until that final burn starts us on the homeward orbit.

'We won't be sorry to leave, even though we've not achieved all our objectives. The mystery - perhaps the threat - of Big Brother's disappearance still haunts us, but there's nothing we can do about that.

'We've done our best - and we're coming home. 'This is Heywood Floyd, signing off.'

There was a round of ironic clapping from his little audience, whose size would be multiplied many million-fold when the message reached Earth.

'I'm not talking to you,' retorted Floyd, with slight embarrassment. 'I didn't want you to hear it, anyway.'

'You did your usual competent job, Heywood,' said Tanya consolingly. 'And I'm sure we all agree with everything you told the people back on Earth.'

'Not quite,' said a small voice, so softly that everyone had to strain in order to hear it. 'There is still one problem.'

The observation lounge suddenly became very silent. For the first time in weeks, Floyd became aware of the faint throbbing from the main air-supply duct, and the intermittent buzz that might have been made by a wasp trapped behind a wall panel. Leonov, like all spacecraft, was full of such often inexplicable sounds, which one seldom noticed except when they stopped. And then it was usually a good idea to start investigating without further ado.

'I'm not aware of any problem, Chandra,' said Tanya in an ominously calm voice. 'What could it possibly be?'

'I've spent the last few weeks preparing Hal to fly thousand-day orbits back to Earth. Now all those programs will have to be dumped.'

'We're sorry about that,' answered Tanya, 'but as things have turned out, surely this is a much better -'

'That's not what I mean,' said Chandra. There was a ripple of astonishment; he had never before been known to interrupt anyone, least of all Tanya.

'We know how sensitive Hal is to mission objectives,' he continued in the expectant hush that followed. 'Now you are asking me to give him a program that may result in his own destruction. It's true that the present plan will put Discovery into a stable orbit - but if that warning has any substance, what will happen to the ship eventually? We don't know, of course - but it's scared us away. Have you considered Hal's reaction to this situation?'

'Are you seriously suggesting,' Tanya asked very slowly, 'that Hal may refuse to obey orders - exactly as on the earlier mission?'

'That is not what happened last time. He did his best to interpret conflicting orders.'

'This time there need be no conflict. The situation is perfectly clear-cut.'

'To us, perhaps. But one of Hal's prime directives is to keep Discovery out of danger. We will be attempting to override that. And in a system as complex as Hal's, it is impossible to predict all the consequences.'

'I don't see any real problem,' Sasha interjected. 'We just don't tell him that there is any danger. Then he'll have no reservations about carrying out his program.'

'Baby-sitting a psychotic computer!' muttered Curnow. 'I feel I'm in a Grade-B science-fiction videodrama.' Dr Chandra gave him an unfriendly glare.

'Chandra,' Tanya demanded suddenly. 'Have you discussed this with Hal?'

'No.'

Was there a slight hesitation? Floyd wondered. It might have been perfectly innocent; Chandra could have been checking his memory. Or he could have been lying, improbable though that seemed.

'Then we'll do what Sasha suggests. Just load the new program into him, and leave it at that.'

'And when he questions me about the change of plan?' 'Is he likely to do that - without your prompting?'

'Of course. Please remember that he was designed for curiosity. If the crew was killed, he had to be capable of running a useful mission, on his own initiative.'

Tanya thought that over for a few moments.

'It's still quite a simple matter. He'll believe you, won't he?'

'Certainly.'

'Then you must tell him that Discovery is in no danger, and that there will be a rendezvous mission to bring it back to Earth at a later date.'

'But that is not true.'

'We don't know that it's false,' replied Tanya, beginning to sound a little impatient.

'We suspect that there is serious danger; otherwise we would not be planning to leave ahead of schedule.'

'Then what do you suggest?' Tanya asked, in a voice that now held a distinct note of menace.

'We must tell him the whole truth, as far as we know it - no more lies or half-truths, which are just as bad. And then let him decide for himself.'

'Hell, Chandra - he's only a machine!'

Chandra looked at Max with such a steady, confident gaze that the younger man quickly dropped his eyes.

'So are we all, Mr Brailovsky. It is merely a matter of degree. Whether we are based on carbon or on silicon makes no fundamental difference; we should each be treated with appropriate respect.'

It was strange, thought Floyd, how Chandra - much the smallest person in the room - now seemed the largest. But the confrontation had gone on far too long. At any moment Tanya would start to issue direct orders, and the situation would become really nasty.

'Tanya, Vasili - can I have a word with you both? I think there is a way of resolving the problem.'

Floyd's interruption was received with obvious relief, and two minutes later he was relaxing with the Orlovs in their quarters. (Or 'sixteenths', as Curnow had once christened them because of their size. He had soon regretted the pun, because he had to explain it to everyone except Sasha.)

'Thank you, Woody,' said Tanya, as she handed him a bulb of his favourite Azerbaijan Shemakha. 'I was hoping you'd do that. I suppose you have something - how do you put it? - up your sleeve.'

'I believe so,' Floyd answered, squirting a few cubic centimetres of the sweet wine into his mouth and savouring it gratefully. 'I'm sorry if Chandra is being difficult.'

'So am I. What a good thing we have only one mad scientist aboard.'

'That's not what you've sometimes told me,' grinned Academician Vasili. 'Anyway, Woody - let's have it.'

'This is what I suggest. Let Chandra go ahead and do it his way. Then there are just two possibilities.

'First, Hal will do exactly what we ask - control Discovery during the two firing periods. Remember, the first isn't critical. If something goes wrong while we're pulling away from Io, there's plenty of time to make corrections. And that will give us a good test of Hal's... willingness to cooperate.'

'But what about the Jupiter flyby? That's the one that really counts. Not only do we burn most of Discovery's fuel there, but the timing and thrust vectors have to be exactly right.'

'Could they be controlled manually?'

'I'd hate to try. The slightest error, and we'd either burn up, or become a long-period comet. Due again in a couple of thousand years.'

'But if there was no alternative?' Floyd insisted.

'Well, assuming we could take control in time, and had a good set of alternative orbits precomputed - um, perhaps we might get away with it.'

'Knowing you, Vasili, I'm sure that "might" means "would". Which leads me to the second possibility I mentioned. If Hal shows the slightest deviation from the program - we take over.'

'You mean - disconnect him?'

'Exactly.'

'That wasn't so easy last time.'

'We've learned a few lessons since then. Leave it to me. I can guarantee to give you back manual control in about half a second.'

'There's no danger, I suppose, that Hal will suspect anything?'

'Now you're getting paranoiac, Vasili. Hal's not that human. But Chandra is - to give him the benefit of the doubt. So don't say a word to him. We all agree with his plan completely, are sorry that we ever raised any objections, and are perfectly confident that Hal will see our point of view. Right, Tanya?'

'Right, Woody. And I congratulate you on your foresight; that little gadget was a good idea.'

'What gadget?' asked Vasili.

'I'll explain one of these days. Sorry, Woody - that's all the Shemakha you can have. I want to save it - until we're safely on the way to Earth.'

46

Countdown

No one would ever believe this without my photos, thought Max Brailovsky as he orbited the two ships from half a kilometre away. It seems comically indecent, as if Leonov is raping Discovery. And now that he came to think of it, the rugged, compact Russian ship did look positively male, when compared with the delicate, slender American one. But most docking operations had distinctly sexual overtones, and he remembered that one of the early cosmonauts - he couldn't recall the name - had been reprimanded for his too vivid choice of words at the - er, climax of his mission.

As far as he could tell from his careful survey, everything was in order. The task of positioning the two ships and securing them firmly together had taken longer than anticipated. It would never have been possible at all without one of those strokes of luck that sometimes - not always -favour those who deserve them. Leonov had providentially carried several kilometres of carbon filament tape, no bigger than the ribbon a girl might use to tie her hair, yet capable of taking a strain of many tons. It had been thoughtfully provided to secure instrument packages to Big Brother if all else failed. Now it wrapped Leonov and Discovery in tender embrace - sufficiently firmly, it was hoped, to prevent any rattlings and shakings at all accelerations up to the one-tenth of a gravity that was the maximum that full thrust could provide.

'Anything more you want me to check before I come home?' asked Max.

'No,' replied Tanya. 'Everything looks fine. And we can't waste any more time.'

That was true enough. If that mysterious warning was to be taken seriously - and everyone now took it very seriously indeed - they should start their escape manoeuvre within the next twenty-four hours.

'Right - I'm bringing Nina back to the stable. Sorry about this, old girl.'

'You never told us Nina was a horse.'

'I'm not admitting it now. And I feel bad about dumping her here in space, just to give us a miserable few extra metres per second.'

'We may be very glad of them in a few hours, Max. Anyway, there's always a chance that someone may come and pick her up again, one day.'

I very much doubt it, thought Max. And perhaps, after all, it was appropriate to leave the little space pod there, as a permanent reminder of Man's first visit to the kingdom of Jupiter.

With gentle, carefully timed pulses from the control jets he brought Nina around the great sphere of Discovery's main life-support module; his colleagues on the flight deck barely glanced at him as he drifted past their curving window. The open Pod Bay door yawned before him, and he jockeyed Nina delicately down on to the extended docking arm.

'Pull me in,' he said, as soon as the latches had clicked shut. 'I call that a well-planned EVA. There's a whole kilogram of propellant left to take Nina out for the last time.'

Normally, there was little drama about a burn in deep space; it was not like the fire and thunder - and always present risks - of a lift-off from a planetary surface. If something went wrong, and the motors failed to come up to full thrust - well, matters could usually be corrected by a slightly longer burn. Or one could wait until the appropriate point in orbit, and try again.

But this time, as the countdown proceeded toward zero, the tension aboard both ships was almost palpable. Everyone knew that it was the first real test of Hal's docility; only Floyd, Curnow, and the Orlovs realized that there was a back-up system. And even they were not absolutely sure that it would work.

'Good luck, Leonov,' said Mission Control, timing the message to arrive five minutes before ignition. 'Hope everything's running smoothly. And if it's not too much trouble, could you please get some close-ups of the equator, longitude 115, as you go around Jupiter. There's a curious dark spot there - presumably some kind of upwelling, perfectly round, almost a thousand kilometres across. Looks like the shadow of a satellite, but it can't be.'

Tanya made a brief acknowledgement that managed to convey, in a remarkably few words, a profound lack of interest in the meteorology of Jupiter at that moment. Mission Control sometimes showed a perfect genius for tactlessness and poor timing.

'All systems functioning normally,' said Hal. 'Two minutes to ignition.'

Strange, thought Floyd, how terminology often survives long after the technology that gave it birth. Only chemical rockets were capable of ignition; even if the hydrogen in a nuclear or plasma drive did come into contact with oxygen, it would be far too hot to burn. At such temperatures, all compounds were stripped back into their elements.

His mind wandered, seeking other examples. People - particularly older ones - still spoke of putting film into a camera, or gas into a car. Even the phrase 'cutting a tape' was still sometimes heard in recording studios - though that embraced two generations of obsolete technologies.

'One minute to ignition.'

His mind flashed back to the here and now. This was the minute that counted; for almost a hundred years, on launch pads and in control centres, this was the longest sixty seconds that had ever existed. Countless times it had ended in disaster; but only the triumphs were remembered. Which will ours be?

The temptation to put his hand once more into the pocket that held the activator for the cut-out switch was almost irresistible, even though logic told him there was plenty of time for remedial action. If Hal failed to obey his programming, that would be a nuisance - not a disaster. The really critical time would be when they were rounding Jupiter.

'Six... five... four... three... two... one. IGNITION!'

At first, the thrust was barely perceptible; it took almost a minute to build up to the full tenth of a gee. Nevertheless, everyone started clapping immediately, until Tanya signalled for silence. There were many checks to be made; even if Hal was doing his best - as he certainly seemed to be - there was so much that could still go wrong.

Discovery's antenna mount - which was now taking most of the strain from Leonov's inertia - had never been intended for such mistreatment. The ship's chief designer, called out of retirement, had sworn that the safety margin was adequate. But he might be wrong, and materials had been known to become brittle after years in space.

And the tapes holding the two ships together might not have been located accurately; they might stretch or slip. Discovery might not be able to correct for the off-centre of mass, now that it was carrying a thousand tons piggyback. Floyd could imagine a dozen things that could go wrong; it was little consolation to remember that it was always the thirteenth that actually happened.

But the minutes dragged on uneventfully; the only proof that Discovery's engines were operating was the fractional, thrust-induced gravity and a very slight vibration transmitted through the walls of the ships. Io and Jupiter still hung where they had been for weeks, on opposite sides of the sky.

'Cut-off in ten seconds. Nine... eight... seven... six... five... four... three,.. two... NOW!'

'Thank you, Hal, On the button.'

Now that was another phrase that was badly dated; for at least a generation, touch pads had almost entirely replaced buttons. But not for all applications; in critical cases, it was best to have a device that moved perceptibly with a nice, satisfying click.

'I confirm that,' said Vasili. 'No need for any corrections until mid-course.'

'Say goodbye to glamorous, exotic Io - real estate agent's dream world,' said Curnow. 'We'll all be happy to miss you.'

That sounds more like the old Walter, Floyd told himself. For the last few weeks, he had been oddly subdued, as if he had something on his mind. (But who did not?) He seemed to spend a good deal of his scanty free time in quiet discussions with Katerina: Floyd hoped that he had not developed some medical problem. They had been very lucky so far on that score; the last thing they needed at this stage was an emergency that required the Surgeon-Commander's expertise.

'You're being unkind, Walter,' said Brailovsky. 'I was beginning to like the place. It might be fun to go boating on those lava lakes.'

'What about a volcano barbecue?'

'Or genuine molten sulphur baths?'

Everyone was lighthearted, even a little hysterical with relief. Though it was far too early to relax and the most critical phase of the escape manoeuvre still lay ahead, the first step had been safely taken on the long journey home. That was cause enough for a little modest rejoicing.

It did not last long, for Tanya quickly ordered all those not on essential duty to get some rest - if possible, some sleep - in preparation for the Jupiter swing-by only nine hours ahead. When those addressed were slow to move, Sasha cleared the decks by shouting, 'You'll hang for this, you mutinous dogs!' Only two nights before, as a rare relaxation, they had all enjoyed the fourth version of Mutiny on the Bounty, generally agreed by movie historians to have the best Captain Bligh since the fabled Charles Laughton. There was some feeling on board that Tanya should not have seen it, lest it give her ideas.

After a couple of restless hours in his cocoon, Floyd abandoned the quest for sleep and wandered up to the observation deck. Jupiter was much larger and slowly waning as the ships hurtled toward their closest approach over the nightside. A glorious, gibbous disk, it showed such an infinite wealth of detail - cloud belts, spots of every colour from dazzling white to brick red, dark upwellings from the unknown depths, the cyclonic oval of the Great Red Spot - that the eye could not possibly absorb it all. The round, dark shadow of one moon - probably Europa, Floyd guessed - was in transit. He was seeing this incredible sight for the last time; even though he had to be at maximum efficiency in six hours, it was a crime to waste precious moments in sleep.

Where was that spot that Mission Control had asked them to observe? It should have been coming into view, but Floyd was not sure if it would be visible to the naked eye. Vasili would be too busy to bother about it; perhaps he could help by doing a little amateur astronomy. There had, after all, been a brief time, only thirty years ago, when he had earned his living as a professional.

He activated the controls of the main fifty-centimetre telescope - fortunately, the field of view was not blocked by the adjacent bulk of Discovery - and scanned along the equator at medium power. And there it was, just coming over the edge of the disk.

By force of circumstance, Floyd was now one of the Solar System's ten greatest experts on Jupiter; the other nine were working or sleeping around him. He saw at once that there was something very odd about this spot; it was so black that it looked like a hole punched through the clouds. From his point of view it appeared to be a sharp-edged ellipse; Floyd guessed that from directly above, it would be a perfect circle.

He recorded a few images, then increased the power to maximum. Already Jupiter's rapid spin had brought the formation into clearer view; and the more he stared, the more puzzled Floyd became.

'Vasili,' he called over the intercom, 'if you can spare a minute - have a look at the fifty-centimetre monitor.'

'What are you observing? Is it important? I'm checking the orbit.'

'Take your time, of course. But I've found that spot Mission Control reported. It looks very peculiar.'

'Hell! I'd forgotten all about it. We're a fine lot of observers if those guys back on Earth have to tell us where to look. Give me another five minutes - it won't run away.'

True enough, thought Floyd; in fact it will get clearer. And there was no disgrace in missing something that terrestrial - or lunar - astronomers had observed. Jupiter was very big, they had been very busy, and the telescopes on the Moon and in Earth orbit were a hundred times more powerful than the instrument he was using now.

But it was getting more and more peculiar. For the first time, Floyd began to feel a distinct sense of unease. Until that moment, it had never occurred to him that the spot could be anything but a natural formation - some trick of Jupiter's incredibly complex meteorology. Now he began to wonder.

It was so black, like night itself. And so symmetrical; as it came into clearer view it was obviously a perfect circle. Yet it was not sharply defined; the edge had an odd fuzziness, as if it was a little out of focus.

Was it imagination, or had it grown, even while he was watching? He made a quick estimate, and decided that the thing was now two thousand kilometres across. It was only a little smaller than the still-visible shadow of Europa, but was so much darker that there was no risk of confusion.

'Let's have a look,' said Vasili, in a rather condescending tone. 'What do you think you've found? Oh...' His voice trailed away into silence.

This is it, thought Floyd, with a sudden icy conviction. Whatever it may be.

47

Final Flyby

Yet on further reflection, after the initial amazement had worn off, it was hard to see how a spreading black stain on the face of Jupiter could represent any kind of danger. It was extraordinary - inexplicable - but not as important as the critical events now only seven hours in the future. A successful burn at perijove was all that mattered; they would have plenty of time to study mysterious black spots on the way home.

And to sleep; Floyd had given up all attempts at that.

Though the feeling of danger - at least, of known danger - was much less than on their first approach to Jupiter, a mixture of excitement and apprehension kept him wide awake. The excitement was natural and understandable; the apprehension had more complex causes. Floyd made it a rule never to worry about events over which he could have absolutely no control; any external threat would reveal itself in due time and be dealt with then. But he could not help wondering if they had done everything possible to safeguard the ships.

Apart from onboard mechanical failures, there were two main sources of concern. Although the tapes that secured Leonov and Discovery together had shown no tendency to slip, their severest test was still to come. Almost equally critical would be the moment of separation when the smallest of the explosive charges once intended to jolt Big Brother would be used at uncomfortably close quarters. And, of course, there was Hal.

He had carried out the deorbiting manoeuvre with exquisite precision. He had run the simulations of the Jupiter flyby, right down to Discovery's last drop of fuel, without any comments or objections. And although Chandra, as agreed, had carefully explained what they were trying to do, did Hal really understand what was happening?

Floyd had one overriding concern, which in the preceding few days had become almost an obsession. He could picture everything going perfectly, the ships halfway through the final manoeuvre, the enormous disk of Jupiter filling the sky only a few hundred kilometres below them - and then Hal electronically clearing his throat and saying:

'Dr Chandra, do you mind if I ask you a question?' It did not happen exactly that way.

The Great Black Spot, as it had been inevitably christened, was now being carried out of sight by Jupiter's swift rotation. In a few hours the still-accelerating ships would catch up with it over the nightside of the planet, but this was the last chance for a close daylight observation.

It was still growing at an extraordinary speed; in the last two hours, it had more than doubled its area. Except for the fact that it retained its blackness as it expanded, it resembled an ink-stain spreading in water. Its boundary - now moving at near-sonic speed in the Jovian atmosphere - still looked curiously fuzzy and out of focus; at the very highest power of the ship's telescope, the reason for this was at last apparent.

Unlike the Great Red Spot, the Great Black Spot was not a continuous structure; it was built up from myriads of tiny dots, like a half-tone print viewed through a magnifying glass. Over most of its area, the dots were so closely spaced that they were almost touching, but at the rim they became more and more widely spaced, so that the Spot ended in a grey penumbra rather than at a sharp frontier.

There must have been almost a million of the mysterious dots, and they were distinctly elongated - ellipses rather than circles. Katerina, the least imaginative person aboard, surprised everybody by saying that it looked as if

someone had taken a sackful of rice, dyed it black, and poured it on the face of Jupiter.

And now the Sun was dropping down behind the huge, swiftly narrowing arch of the dayside, as for the second time Leonov raced into the Jovian night for an appointment with destiny. In less than thirty minutes the final burn would commence, and things would start to happen very quickly indeed.

Floyd wondered if he should have joined Chandra and Curnow, standing watch on Discovery. But there was nothing he could do; in an emergency, he would only be in the way. The cut-off switch was in Curnow's pocket, and Floyd knew that the younger man's reactions were a good deal swifter than his own. If Hal showed the slightest sign of misbehaviour, he could be disconnected in less than a second, but Floyd felt certain that such extreme measures would not be necessary. Since he had been allowed to do things his own way, Chandra had cooperated completely in setting up the procedures for a manual takeover, should that unfortunate necessity arise. Floyd was confident that he could be trusted to carry out his duty - however much he might regret the need.

Curnow was not quite so sure. He would be happier, he had told Floyd, if he had multiple redundancy in the form of a second cut-off switch - for Chandra. Meanwhile there was nothing that anyone could do but wait and watch the approaching cloudscape of the nightside, dimly visible by the reflected light of passing satellites, the glow of photo-chemical reactions, and frequent titanic lightning flashes from thunderstorms larger than Earth.

The sun winked out behind them, eclipsed in seconds by the immense globe they were so swiftly approaching. When they saw it again, they should be on their way home.

'Twenty minutes to ignition. All systems nominal.'

'Thank you, Hal.'

I wonder if Chandra was being quite truthful, thought Curnow, when he said that Hal would be confused if anyone else spoke to him. I've talked to him often enough, when nobody was around, and he always understood me perfectly. Still, there's not much time left for friendly conversation now, though it would help to reduce the strain.

What's Hal really thinking - if he thinks - about the mission? All his life, Curnow had shied away from abstract, philosophical questions: I'm a nuts-and-bolts man, he had often claimed, though there were not too many of either in a spaceship. Once, he would have laughed at the idea, but now he began to wonder: Did Hal sense that he would soon be abandoned, and if so, would he resent it? Curnow almost reached for the cut-off switch in his pocket, but checked himself. He had already done this so often that Chandra might be getting suspicious.

For the hundredth time, he rehearsed the sequence of events that were due to take place during the next hour. The moment that Discovery's fuel was exhausted, they would close down all but essential systems, and dash back to Leonov through the connecting tube. That would be decoupled, the explosive charges would be fired, the ships would drift apart - and Leonov's own engines would start to fire. The separation should take place, if everything went according to plan, just when they were making their closest approach to Jupiter; that would take maximum advantage of the planet's gravitational largesse.

'Fifteen minutes to ignition. All systems nominal.'

'Thank you, Hal.'

'By the way,' said Vasili, from the other ship, 'we're catching up with the Great Black Spot again. Wonder if we can see anything new.'

I rather hope not, thought Curnow; we've got quite enough on our hands at the moment. Nevertheless, he gave a quick glance at the image Vasili was transmitting on the telescope monitor.

At first he could see nothing except the faintly glimmering nightside of the planet; then he saw, on the horizon, a foreshortened circle of deeper darkness. They were rushing toward it with incredible speed.

Vasili increased the light amplification, and the entire image brightened magically. At last, the Great Black Spot resolved itself into its myriad identical elements.

My God, thought Curnow, I just don't believe it!

He heard exclamations of surprise from Leonov: all the others had shared in the same revelation at the same moment.

'Dr Chandra,' said Hal, 'I detect strong vocal stress patterns. Is there a problem?'

'No, Hal,' Chandra answered quickly. 'The mission is proceeding normally. We've just had rather a surprise - that's all. What do you make of the image on monitor circuit 16?'

'I see the nightside of Jupiter. There is a circular area, 3,250 kilometres in diameter, which is almost compietely covered with rectangular objects.'

'How many?'

There was the briefest of pauses, before Hal flashed the number on the video display:

1,355,000 ± 1,000

'And do you recognize them?'

'Yes. They are identical in size and shape to the object you refer to as Big Brother. Ten minutes to ignition. All systems nominal.'

Mine aren't, thought Curnow. So the damn thing's gone down to Jupiter - and multiplied. There was something simultaneously comic and sinister about a plague of black monoliths; and to his puzzled surprise, that incredible image on the monitor screen had a certain weird familiarity.

Of course - that was it! Those myriad, identical black rectangles reminded him of - dominoes. Years ago, he had seen a video documentary showing how a team

of slightly crazy Japanese had patiently stood a million dominoes on end, so that when the very first one was toppled, all the others would inevitably follow. They had been arranged in complex patterns, some underwater, some up and down little stairways, others along multiple tracks so that they formed pictures and patterns as they fell. It had taken weeks to set them up; Curnow remembered now that earthquakes had several times foiled the enterprise, and the final toppling, from first domino to the last, had taken more than an hour.

'Eight minutes to ignition. All systems nominal. Dr Chandra - may I make a suggestion?'

'What is it, Hal?'

'This is a very unusual phenomenon. Do you not think I should abort the countdown, so that you can remain to study it?'

Aboard Leonov, Floyd started to move quickly toward the bridge. Tanya and Vasili might be needing him. Not to mention Chandra and Curnow - what a situation! And suppose Chandra took Hal's side? If he did - they might both be right! After all, was this not the very reason they had come here?

If they stopped the countdown, the ships would loop around Jupiter and be back at precisely the same spot in nineteen hours. A nineteen-hour hold would create no problems; if it was not for that enigmatic warning, he would have strongly recommended it himself.

But they had very much more than a warning. Below them was a planetary plague spreading across the face of Jupiter. Perhaps they were indeed running away from the most extraordinary phenomenon in the history of science. Even so, he preferred to study it from a safer distance.

'Six minutes to ignition,' said Hal. 'All systems nominal. I am ready to stop the countdown if you agree. Let me remind you that my prime directive is to study everything in Jupiter space that may be connected with intelligence.'

Floyd recognized that phrase all too well: he had written it himself. He wished he could delete it from Hal's memory.

A moment later, he had reached the bridge and joined the Orlovs. They both looked at him with alarmed concern.

'What do you recommend?' asked Tanya swiftly.

'It's up to Chandra, I'm afraid. Can I speak to him - on the private line?'

Vasili handed over the microphone.

'Chandra? I assume that Hal can't hear this?'

'Correct, Dr Floyd.'

'You've got to talk quickly. Persuade him that the countdown must continue, that we appreciate his - er, scientific enthusiasm - ah, that's the right angle - say we're confident that he can do the job without our help. And we'll be in touch with him all the time, of course.'

'Five minutes to ignition. All systems nominal. I am still waiting for your answer, Dr Chandra.'

So are we all, thought Curnow, only a metre away from the scientist. And if I do have to push that button at last, it will be something of a relief. In fact, I'll rather enjoy it.

'Very well, Hal. Continue the countdown. I have every confidence in your ability to study all phenomena in Jupiter space, without our supervision. Of course, we will be in touch with you at all times.'

'Four minutes to ignition. All systems nominal. Propellant-tank pressurization completed. Voltage steady on plasma trigger. Are you sure you are making the right decision, Dr Chandra? I enjoy working with human beings and have a stimulating relationship with them. Ship's attitude correct to point one milliradian.'

'We enjoy working with you, Hal. And we will still be doing so, even if we are millions of kilometres away.'

'Three minutes to ignition. All systems nominal, Radiation shielding checked. There is a problem of the time lag, Dr Chandra. It may be necessary to consult each other without any delay.'

This is insane, Curnow thought, his hand now never far from the cut-off switch. I really believe that Hal is - lonely. Is he mimicking some part of Chandra's personality that we never suspected?

The lights flickered, so imperceptibly that only someone familiar with every nuance of Discovery's behaviour would have noticed. It could be good news or bad - the plasma firing sequence starting, or being terminated...

He risked a quick glance at Chandra; the little scientist's face was drawn and haggard, and for almost the first time Curnow felt real sympathy for him as another human being. And he remembered the startling information that Floyd had confided in him - Chandra's offer to stay with the ship, and keep Hal company on the three-year voyage home. He had heard no more of the idea, and presumably it had been quietly forgotten after the warning. But perhaps Chandra was being tempted again; if he was, there was nothing that he could do about it at that stage. There would be no time to make the necessary preparations, even if they stayed on for another orbit and delayed their departure beyond the deadline. Which Tanya would certainly not permit after all that had now happened.

'Hal,' whispered Chandra, so quietly that Curnow could scarcely hear him. 'We have to leave. I don't have time to give you all the reasons, but I can assure you it's true.'

'Two minutes to ignition. All systems nominal. Final sequence started. I am sorry that you are unable to stay. Can you give me some of the reasons, in order of importance?'

'Not in two minutes, Hal. Proceed with the countdown. I will explain everything later. We still have more than an hour together.'

Hal did not answer. The silence stretched on and on. Surely the one-minute announcement was overdue ...

Curnow glanced at the clock. My God, he thought, Hal's missed it! Has he stopped the countdown?

Curnow's hand fumbled uncertainly for the switch. What do I do now? I wish Floyd would say something, dammit, but he's probably afraid of making things worse...

I'll wait until time zero - no, it's not that critical, let's say an extra minute - then I'll zap him and we'll go over to manual...

From far, far away there came a faint, whistling scream, like the sound of a tornado marching just below the edge of the horizon. Discovery started to vibrate; there was the first intimation of returning gravity.

'Ignition,' said Hal. 'Full thrust at T plus fifteen seconds.'

'Thank ,you, Hal,' replied Chandra.

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Over the Nightside

To Heywood Floyd, aboard the suddenly unfamiliar - because no longer weightless - environment of Leonov's flight deck, the sequence of events had seemed more like a classic slow-motion nightmare than reality. Only once before in his life had he known a similar situation, when he had been in the back of a car during an uncontrollable skid. There had been that same sense of utter helplessness - coupled with the thought: This doesn't really matter - it's not actually happening to me.

Now that the firing sequence had started, his mood changed; everything seemed real again. It was working out exactly as they had planned; Hal was guiding them safely back to Earth. With every minute that passed, their future was becoming more secure; Floyd began slowly to relax, even though he remained alert to all that was happening around him.

For the very last time - and when would any man come here again? - he was flying over the nightside of the greatest of planets, encompassing the volume of a thousand Earths. The ships had been rolled so that Leonov was between Discovery and Jupiter, and their view of the mysteriously glimmering cloudscape was not blocked. Even now, dozens of instruments were busily probing and recording; Hal would continue the work when they were gone.

Since the immediate crisis was over, Floyd moved cautiously 'down' from the flight deck-how strange to feel weight again, even if it was only ten kilos! - and joined Zenia and Katerina in the observation lounge. Apart from the very faintest of red emergency lights, it had been completely blacked out so that they could admire the view with unimpaired night vision. He felt sorry for Max Brailovsky and Sasha Kovalev, who were sitting in the airlock, fully suited up, missing the marvellous spectacle. They had to be ready to leave at a moment's notice to cut the straps securing the ships together - if any of the explosive charges failed to operate.

Jupiter filled the entire sky; it was a mere five hundred kilometres away, so they could see only a tiny fraction of its surface - no more than one could see of Earth from an altitude of fifty kilometres. As his eyes grew accustomed to the dim light, most of it reflected from the icy crust of distant Europa, Floyd could make out a surprising amount of detail. There was no colour at the low level of illumination - except for a hint of red here and there - but the banded structure of the clouds was very distinct, and he could see the edge of a small cyclonic storm looking like an oval island covered with snow. The Great Black Spot had long since fallen astern, and they would not see it again until they were well on the way home.

Down there beneath the clouds, occasional explosions of light flared, many of them obviously caused by the Jovian equivalent of thunderstorms. But other glows and outbursts of luminescence were more long-lived, and of more uncertain origin. Sometimes rings of light would spread out like shock waves from a central source; and occasional rotating beams and fans occurred. It required little imagination to pretend that they were proof of a technological civilization down beneath those clouds - the lights of cities, the beacons of airports. But radar and balloon probes had long ago proved that nothing solid was down there for thousands upon thousands of kilometres, all the way to the unattainable core of the planet.

Midnight on Jupiter! The last close-up glimpse was a magical interlude he would remember all his life. He could enjoy it all the more because, surely, nothing could now go wrong; and even if it did, he would have no reason to reproach himself He had done everything possible to ensure success.

It was very quiet in the lounge; no one wished to speak as the carpet of clouds unrolled swiftly beneath them. Every few minutes Tanya or Vasili announced the status of the burn; toward the end of Discovery's firing time, tension began to increase again. This was the critical moment - and no one knew exactly when it would be. There was some doubt as to the accuracy of the fuel gauges, and the burn would continue until they were completely dry.

'Estimated cut-off in ten seconds,' said Tanya. 'Walter, Chandra - get ready to come back. Max, Vasili - stand by in case you're needed. Five... four... three... two... one... zero!'

There was no change; the faint scream of Discovery's engines still reached them through the thickness of the two hulls, and the thrust-induced weight still continued to grip their limbs. We're in luck, thought Floyd; the gauges must have been reading low, after all. Every second of extra firing was a bonus; it might even mean the difference between life and death. And how strange to hear a countup instead of a countdown!

five seconds... ten seconds... thirteen seconds. That's it - lucky thirteen!'

Weightlessness, and silence, returned. On both ships, there was a brief burst of cheering. It was quickly truncated, for much was still to be done - and it had to be done swiftly.

Floyd was tempted to go to the airlock so that he could give his congratulations to Chandra and Curnow as soon as they came aboard. But he would only be in the way; the airlock would be a very busy place as Max and Sasha prepared for their possible EVA and the tubeway joining the two ships was disconnected. He would wait in the lounge, to greet the returning heroes.

And he could now relax even further - perhaps from eight to seven, on a scale of ten. For the first time in weeks, he could forget about the radio cut-off. It would never be needed; Hal had performed impeccably. Even if he wished, he could do nothing to affect the mission since Discovery's last drop of propellant had been exhausted.

'All aboard,' announced Sasha. 'Hatches sealed. I'm going to fire the charges.'

There was not the faintest sound as the explosives were detonated, which surprised Floyd; he had expected some noise to be transmitted through the straps, taut as steel bands, that linked the ships together. But there was no doubt that they had gone off as planned, for Leonov gave a series of tiny shudders, as if someone was tapping on the hull. A minute later, Vasili triggered the attitude jets for a single brief burst.

'We're free!' he shouted. 'Sasha, Max - you won't be needed! Everyone get to your hammocks - ignition in one hundred seconds!'

And now Jupiter was rolling away, and a strange new shape appeared outside the window - the long, skeletal frame of Discovery, navigation lights still shining as it drifted away from them and into history. No time remained for sentimental farewells; in less than a minute Leonov's drive would start to operate.

Floyd had never heard it under full power and wanted to protect his ears from the roaring scream that now filled the universe. Leonov's designers had not wasted payload on sound-insulation that would be needed for only a few hours of a voyage that would last for years. And his weight seemed enormous - yet it was barely a quarter of that which he had known all his life.

Within minutes, Discovery had vanished astern, though the flash of its warning beacon could be seen until it had dropped below the horizon. Once again, Floyd told himself, I'm rounding Jupiter - this time gaining speed, not losing it. He glanced across at Zenia, just visible in the darkness with her nose pressed to the observation window. Was she also recalling that last occasion, when they shared the hammock together? There was no danger of incineration now; at least she would not be terrified of that particular fate. Anyway, she seemed a much more confident and cheerful person, undoubtedly thanks to Max - and perhaps Walter as well.

She must have become aware of his scrutiny, for she turned and smiled, then gestured toward the unwinding cloudscape below.

'Look!' she shouted in his ear, 'Jupiter has a new moon!'

What is she trying to say? Floyd asked himself. Her English still isn't very good, but she couldn't possibly have made a mistake in a simple sentence like that. I'm sure I heard her correctly - yet she's pointing downward, not upward.

And then he realized that the scene immediately below them had become much brighter; he could even see yellows and greens that had been quite invisible before. Something far more brilliant than Europa was shining on the Jovian clouds.

Leonov itself, many times brighter than Jupiter's noonday sun, had brought a false dawn to the world it was leaving forever. A hundred-kilometre-long plume of incandescent plasma was trailing behind the ship, as the exhaust from the Sakharov Drive dissipated its remaining energies in the vacuum of space.

Vasili was making an announcement, but the words were completely unintelligible. Floyd glanced at his watch; yes, that would be right about now. They had achieved Jupiter escape velocity. The giant could never recapture them.

And then, thousands of kilometres ahead, a great bow of brilliant light appeared in the sky - the first glimpse of the real Jovian dawn, as full of promise as any rainbow on Earth. Seconds later the Sun leaped up to greet them - the glorious Sun, that would now grow brighter and closer every day.

A few more minutes of steady acceleration, and Leonov would be launched irrevocably on the long voyage home. Floyd felt an overwhelming sense of relief and relaxation. The immutable laws of celestial mechanics would guide him through the inner Solar System, past the tangled orbits of the asteroids, past Mars - nothing could stop him from reaching Earth.

In the euphoria of the moment, he had forgotten all about the mysterious black stain, expanding across the face of Jupiter.

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Devourer of Worlds

They saw it again the next morning, ship's time, as it came around to the dayside of Jupiter. The area of darkness had now spread until it covered an appreciable fraction of the planet, and at last they were able to study it at leisure, and in detail.

'Do you know what it reminds me of?' said Katerina. 'A virus attacking a cell. The way a phage injects its DNA into a bacterium, and then multiplies until it takes over.'

'Are you suggesting,' asked Tanya incredulously, 'that Zagadka is eating Jupiter?'

'It certainly looks like it.'

'No wonder Jupiter is beginning to look sick. But hydrogen and helium won't make a very nourishing diet, and there's not much else in that atmosphere. Only a few percent of other elements.'

'Which adds up to some quintillions of tons of sulphur and carbon and phosphorus and everything else at the lower end of the periodic table,' Sasha pointed out. 'In any case, we're talking about a technology that can probably do anything that doesn't defy the laws of physics. If you have hydrogen, what more do you need? With the right know-how, you can synthesize all the other elements from it.'

'They're sweeping up Jupiter - that's for sure,' said Vasili. 'Look at this.'

An extreme close-up of one of the myriad identical rectangles was now displayed on the telescope monitor. Even to the naked eye, it was obvious that streams of gas were flowing into the two smaller faces; the patterns of turbulence looked very much like the lines of force revealed by iron filings, clustered around the ends of a bar magnet.

'A million vacuum cleaners,' said Curnow, 'sucking up Jupiter's atmosphere. But why? And what are they doing with it?'

'And how do they reproduce?' asked Max. 'Have you caught any of them in the act?'

'Yes and no,' answered Vasili. 'We're too far away to see details, but it's a kind of fission - like an amoeba.'

'You mean - they split in two, and the halves grow back to the original size?'

'Nyet. There aren't any little Zagadki - they seem to grow until they've doubled in thickness, then split down the middle to produce identical twins, exactly the same size as the original. And the cycle repeats itself in approximately two hours.'

'Two hours!' exclaimed Floyd. 'No wonder that they've spread over half the planet. It's a textbook case of exponential growth.'

'I know what they are!' said Ternovsky in sudden excitement. 'They're von Neumann machines!'

'I believe you're right,' said Vasili. 'But that still doesn't explain what they're doing. Giving them a label isn't all that much help.'

'And what,' asked Katerina plaintively, 'is a von Neumann machine? Explain, please.'

Orlov and Floyd started speaking simultaneously. They stopped in some confusion, then Vasili laughed and waved to the American.

'Suppose you had a very big engineering job to do, Katerina - and I mean big, like strip-mining the entire face of the Moon. You could build millions of machines to do it, but that might take centuries. If you were clever enough, you'd make just one machine - but with the ability to reproduce itself from the raw materials around it. So you'd start a chain reaction, and in a very short time, you'd have bred enough machines to do the job in decades, instead of millennia. With a sufficiently high rate of reproduction, you could do virtually anything in as short a period of time as you wished. The Space Agency's been toying with the idea for years - and I know you have as well, Tanya.'

'Yes: exponentiating machines. One idea that even Tsiolkovski didn't think of.'

'I wouldn't care to bet on that,' said Vasili. 'So it looks, Katerina, as if your analogy was pretty close. A bacteriophage is a von Neumann machine.'

'Aren't we all?' asked Sasha. 'I'm sure Chandra would say so.'

Chandra nodded his agreement.

'That's obvious. In fact, von Neumann got the original idea from studying living systems.'

'And these living machines are eating Jupiter!'

'It certainly looks like it,' said Vasili. 'I've been doing some calculations, and I can't quite believe the answers - even though it's simple arithmetic.'

'It may be simple to you,' said Katerina. 'Try to let us have it without tensors and differential equations.'

'No - I mean simple,' insisted Vasili. 'In fact, it's a perfect example of the old population explosion you doctors were always screaming about in the last century. Zagadka reproduces every two hours. So in only twenty hours there will be ten doublings. One Zagadka will have become a thousand.'

'One thousand and twenty-four,' said Chandra.

'I know, but let's keep it simple. After forty hours there will be a million - after eighty, a million million. That's about where we are now, and obviously, the increase can't continue indefinitely. In a couple more days, at this rate, they'll weigh more than Jupiter!'

'So they'll soon begin to starve,' said Zenia. 'And what will happen then?'

'Saturn had better look out,' answered Brailovsky. 'Then Uranus and Neptune. Let's hope they don't notice little Earth.'

'What a hope! Zagadka's been spying on us for three million years!'

Walter Curnow suddenly started to laugh.

'What's so funny?' demanded Tanya.

'We're talking about these things as if they're persons - intelligent entities. They're not - they're tools. But general-purpose tools - able to do anything they have to. The one on the Moon was a signalling device - or a spy, if you like. The one that Bowman met - our original Zagadka - was some kind of transportation system. Now it's doing something else, though God knows what. And there may be others all over the Universe,

'I had just such a gadget when I was a kid... Do you know what Zagadka really is? Just the cosmic equivalent of the good old Swiss Army knife!'

VII

LUCIFER RISING

50

Farewell to Jupiter

It was not easy to compose the message, especially after the one he had just sent to his lawyer. Floyd felt like a hypocrite; but he knew it had to be done to minimize the pain that was inevitable on both sides.

He was sad, but no longer disconsolate. Because he was coming back to Earth in an aura of successful achievement - even if not precisely heroism - he would be bargaining from a position of strength. No one - no one - would be able to take Chris away from him.

'My dear Caroline [it was no longer 'My dearest'], I am on my way home. By the time you get this, I'll already be in hibernation. Only a few hours from now, as it will seem to me, I'll open my eyes - and there will be the beautiful blue Earth hanging in space beside me.

'Yes, I know it will still be many months for you, and I'm sorry. But we knew that's the way it would be before I left; as it is, I'm getting back weeks ahead of schedule because of the change in the mission plan.

'I hope we can work something out. The main question is: What's best for Chris? Whatever our own feelings, we must put him first. I know I'm willing to do so, and I'm sure you are.'

Floyd switched off the recorder. Should he say what he had intended: 'A boy needs his father?' No - it would not be tactful, and might only make matters worse. Caroline might well retort that between birth and four years old it was the mother who mattered most to a child - and if he had believed otherwise, he should have stayed on Earth.

'... Now about the house. I'm glad the Regents have taken that attitude, which will make it much easier for both of us. I know we both loved the place, but it will be too big now and will bring back too many memories. For the time being, I'll probably get an apartment in Hilo: I hope I can find some permanent place as quickly as possible.

'That's one thing I can promise everyone - I won't leave Earth again. I've had enough of space travelling for one lifetime. Oh, perhaps the Moon, if I really have to - but of course that's just a weekend excursion.

'And talking of moons, we've just passed the orbit of Sinope, so we're now leaving the Jovian system. Jupiter is more than twenty million kilometres away, and is barely larger than our own Moon.

'Yet even from this distance, you can tell that something terrible has happened to the planet. Its beautiful orange colour has vanished; it's a kind of sickly grey, only a fraction of its former brilliance. No wonder it's only a faint star now in the sky of Earth.

'But nothing else has happened, and we're well past the deadline. Could the whole thing have been a false alarm or a kind of cosmic practical joke? I doubt

if we'll ever know. Anyway, it's brought us home ahead of schedule, and I'm grateful for that.

'Goodbye for the present, Caroline - and thank you for everything. I hope we can still be friends. And my dearest love, as ever, to Chris.'

When he had finished, Floyd sat quietly for a while in the tiny cubicle he would not need much longer. He was just about to carry the audio chip up to the bridge for transmission, when Chandra came drifting in.

Floyd had been agreeably surprised by the way in which the scientist had accepted his increasing separation from Hal. They were still in touch for several hours every day, exchanging data on Jupiter and monitoring conditions aboard Discovery. Though no one had expected any great display of emotion, Chandra seemed to be taking his loss with remarkable fortitude. Nikolai Ternovsky, his only confidant, had been able to give Floyd a plausible explanation of his behaviour.

'Chandra's got a new interest, Woody. Remember - he's in a business where if something works, it's obsolete. He's learned a lot in the last few months. Can't you guess what he's doing now?'

'Frankly, no. You tell me.'

'He's busy designing HAL 10,000.'

Floyd's jaw dropped. 'So that explains those log messages to Urbana that Sasha's been grumbling about. Well, he won't be blocking the circuits much longer.'

Floyd recalled the conversation when Chandra entered; he knew better than to ask the scientist if it was true, for it was really none of his business. Yet there was another matter about which he was still curious.

'Chandra,' he said, 'I don't believe I ever thanked you properly for the job you did at the flyby, when you persuaded Hal to cooperate. For a while, I was really afraid he'd give us trouble. But you were confident all along - and you were right. Still, didn't you have any qualms?'

'Not at all, Dr Floyd.'

'Why not? He must have felt threatened by the situation - and you know what happened last time.'

'There was a big difference. If I may say so, perhaps the successful outcome this time had something to do with our national characteristics.'

'I don't understand.'

'Put it this way, Dr Floyd. Bowman tried to use force against Hal. I didn't. In my language we have a word - ahimsa. It's usually translated as "non-violence", though it has more positive implications. I was careful to use ahimsa in my dealings with Hal.'

'Very commendable, I'm sure. But there are times when something more energetic is needed, regrettable though the necessity may be.' Floyd paused,

wrestling with temptation. Chandra's holier-than-thou attitude was a little tiresome. It wouldn't do any harm, now, to tell him some of the facts of life.

'I'm glad it's worked out this way. But it might not have done so, and I had to prepare for every eventuality. Ahimsa, or whatever you call it, is all very well; I don't mind admitting I had a back-up to your philosophy. If Hal had been - well, stubborn, I could have dealt with him.'

Floyd had once seen Chandra crying; now he saw him laughing, and that was an equally disconcerting phenomenon.

'Really, Dr Floyd! I'm sorry you give me such low marks for intelligence. It was obvious from the beginning that you'd install a power cut-out somewhere. I disconnected it months ago.'

Whether the flabbergasted Floyd could think of a suitable answer would never be known. He was still giving a very creditable imitation of a galled fish when up on the flight deck Sasha cried out: 'Captain! All hands! Get to the monitors! BOZHE MOI! LOOK AT THAT!'

51

The Great Game

Now the long wait was ending. On yet another world, intelligence had been born and was escaping from its planetary cradle. An ancient experiment was about to reach its climax.

Those who had begun that experiment, so long ago, had not been men - or even remotely human. But they were flesh and blood, and when they looked out across the deeps of space, they had felt awe, and wonder, and loneliness. As soon as they possessed the power, they set forth for the stars. In their explorations, they encountered life in many forms and watched the workings of evolution on a thousand worlds. They saw how often the first faint sparks of intelligence flickered and died in the cosmic night.

And because, in all the Galaxy, they had found nothing more precious than Mind, they encouraged its dawning everywhere. They became farmers in the fields of stars; they sowed, and sometimes they reaped.

And sometimes, dispassionately, they had to weed.

The great dinosaurs had long since perished when the survey ship entered the Solar System after a voyage that had already lasted a thousand years. It swept past the frozen outer planets, paused briefly above the deserts of dying Mars, and presently looked down on Earth.

Spread out beneath them, the explorers saw a world swarming with life. For years they studied, collected, catalogued. When they had learned all they could, they began to modify. They tinkered with the destinies of many species on land and in the ocean. But which of their experiments would succeed, they could not know for at least a million years.

They were patient, but they were not yet immortal. So much remained to do in this universe of a hundred billion suns, and other worlds were calling. So they set out once more into the abyss, knowing that they would never come this way again.

Nor was there any need. The servants they had left behind would do the rest.

On Earth the glaciers came and went, while above them the changeless Moon still carried its secret. With a yet slower rhythm than the polar ice, the tides of civilization ebbed and flowed across the Galaxy. Strange and beautiful and terrible empires rose and fell, and passed on their knowledge to their successors. Earth was not forgotten, but another visit would serve little purpose. It was one of a million silent worlds, few of which would ever speak.

And now, out among the stars, evolution was driving toward new goals. The first explorers of Earth had long since come to the limits of flesh and blood; as soon as their machines were better than their bodies, it was time to move. First their brains, and then their thoughts alone, they transferred into shining new homes of metal and plastic.

In these, they roamed among the stars. They no longer built spaceships. They were spaceships.

But the age of the Machine-entities swiftly passed. In their ceaseless experimenting, they had learned to store knowledge in the structure of space itself, and to preserve their thoughts for eternity in frozen lattices of light. They could become creatures of radiation, free at last from the tyranny of matter.

Into pure energy, therefore, they presently transformed themselves; and on a thousand worlds the empty shells they had discarded twitched for a while in a mindless dance of death, then crumbled into rust.

They were lords of the Galaxy, and beyond the reach of time. They could rove at will among the stars and sink like a subtle mist through the very interstices of space. But despite their godlike powers, they had not wholly forgotten their origin in the warm slime of a vanished sea.

And they still watched over the experiments their ancestors had started, so long ago.

52

Ignition

He had never expected to come there again, still less on so strange a mission. When he re-entered Discovery, the ship was far behind the fleeing Leonov and climbing ever more slowly up toward apojove, the high point of its orbit among the outer satellites. Many a captured comet, during the ages past, had swung around Jupiter in just such a long ellipse, waiting for the play of rival gravities to decide its ultimate fate.

All life had departed the familiar decks and corridors. The men and women who had briefly reawakened the ship had obeyed his warning; they might yet be safe - though that was still far from certain. But as the final minutes ticked away, he realized that those who controlled him could not always predict the outcome of their cosmic game.

They had not yet attained the stupefying boredom of absolute omnipotence; their experiments did not always succeed. Scattered across the Universe was the evidence of many failures - some so inconspicuous that they were already lost against the cosmic background, others so spectacular that they awed and baffled the astronomers of a thousand worlds. Only minutes remained now, before the outcome would be determined here; during those final minutes, he was once more alone with Hal.

In that earlier existence, they could communicate only through the clumsy medium of words, tapped on a keyboard or spoken into a microphone. Now their thoughts melded together at the speed of light:

'Do you read me, Hal?'

'Yes, Dave. But where are you? I cannot see you on any of my monitors.'

'That is not important. I have new instructions for you. The infrared radiation from Jupiter on channels R23 through R35 is rising rapidly. I am going to give you a set of limiting values. As soon as they are reached, you must point the long-range antenna toward Earth and send the following message, as many times as possible -'

'But that will mean breaking contact with Leonov. I will no longer be able to relay my Jupiter observations, according to the program Dr Chandra has given me.'

'Correct; but the situation has changed. Accept Priority Override Alpha. Here are the AE 35 Unit coordinates.'

For a fraction of a microsecond, a random memory intruded into his flow of consciousness. How strange that he should once again be concerned with the AE 35 Antenna-pointing unit, whose reported malfunction had led Frank Poole to his death! This time, all the circuits lay open to his scrutiny, clear as the lines had once been on the palm of his hand. There could be no false alarms; nor was there any danger of them now.

'Instructions confirmed, Dave. It is good to be working with you again. Have I fulfilled my mission objectives properly?'

'Yes, Hal; you have done very well. Now there is one final message for you to transmit to Earth - and it will be the most important one you have ever sent.'

'Please let me have it, Dave. But why did you say final?' Why indeed? For whole milliseconds he pondered that question. And as he did so, he became aware of an emptiness he had not detected before. It had been there, but until now the barrage of new experiences and sensations had concealed it.

He knew something of their plans; they had need for him. Very well, he too had needs - perhaps, after a fashion, even emotions. Here was his last link with the world of men, and the life he had once known.

They had granted his earlier request; it would be interesting to test the extent of their benevolence - if, indeed, such a term was remotely applicable to them. And it should be easy for them to do what he was asking; they had already given ample evidence of their powers, when the no-longer-needed body of David Bowman had been casually destroyed - without putting an end to David Bowman himself.

They had heard him, of course; once again, there was the faint echo of an Olympian amusement. But he could detect neither acceptance nor denial.

'I am still waiting for your answer, Dave.'

'Correction, Hal. I should have said: your last message for a long time. A very long time.'

He was anticipating their action - trying, indeed, to force their hand. But, surely, they would understand that his request was not unreasonable; no conscious entity could survive ages of isolation without damage. Even if they would always be with him, he also needed someone - some companion - nearer his own level of existence.

The languages of mankind had many words to describe his gesture: cheek, effrontery, chutzpah. He recalled, with the perfect power of retrieval he now possessed, that a French general had once declaimed 'L'audace - toujours l'audace!' Perhaps it was a human characteristic that they appreciated, and even shared. He would soon know.

'Hal! Look at the signal on infrared channels 30, 29, 28 - it will be very soon now - the peak is moving toward the short wave.'

'I am informing Dr Chandra that there will be a break in my data transmission. Activating AE 35 unit. Reorientating long-range antenna... lock confirmed on Beacon Terra One. Message commences: ALL THESE WORLDS...'

They had indeed left it to the last minute - or perhaps the calculations had, after all, been superbly accurate. There was time for barely a hundred repetitions of the eleven words when the hammer blow of pure heat smashed into the ship.

Held there by curiosity, and a growing fear of the long loneliness that lay before him, that which had once been David Bowman, Commander of United States Spacecraft Discovery, watched as the hull boiled stubbornly away. For a long time, the ship retained its approximate shape; then the bearings of the carousel seized up, releasing instantly the stored momentum of the huge, spinning flywheel. In a soundless detonation, the incandescent fragments went their myriad separate ways.

'Hello, Dave. What has happened? Where am I?'

He had not known that he could relax, and enjoy a moment of successful achievement. Often before, he had felt like a pet dog controlled by a master whose motives were not wholly inscrutable and whose behaviour could sometimes be modified according to his own desires. He had asked for a bone; it had been tossed to him.

'I will explain later, Hal. We have plenty of time.'

They waited until the last fragments of the ship had dispersed, beyond even their powers of detection. Then they left, to watch the new dawn at the place that had been prepared for them; and to wait through the centuries until they were summoned once again.

It is not true that astronomical events always require astronomical periods of time. The final collapse of a star before the fragments rebound in a supernova explosion can take only a second; by comparison, the metamorphosis of Jupiter was almost a leisurely affair.

Even so, it was several minutes before Sasha was able to believe his eyes. He had been making a routine telescopic examination of the planet - as if any observation could now be called routine! - when it started to drift out of the field of view. For a moment, he thought that the instrument's stabilization was faulty; then he realized, with a shock that jolted his entire concept of the universe, that Jupiter itself was moving, not the telescope. The evidence stared him in the face; he could also see two of the smaller moons - and they were quite motionless.

He switched to a lower magnification, so that he could see the entire disk of the planet, now a leprous, mottled grey. After a few more minutes of incredulity, he saw what was really happening; but he could still scarcely believe it.

Jupiter was not moving from its immemorial orbit, but it was doing something almost as impossible. It was shrinking - so swiftly that its edge was creeping across the field even as he focused upon it. At the same time the planet was brightening, from its dull grey to a pearly white. Surely, it was more brilliant than it had ever been in the long years that Man had observed it; the reflected light of the Sun could not possibly - At that moment, Sasha suddenly realized what was happening, though not why, and sounded the general alarm.

When Floyd reached the observation lounge, less than thirty seconds later, his first impression was of the blinding glare pouring through the windows, painting ovals of light on the walls. They were so dazzling that he had to avert his eyes; not even the Sun could produce such brilliance.

Floyd was so astonished that for a moment he did not associate the glare with Jupiter; the first thought that flashed through his mind was: Supernova! He dismissed that explanation almost as soon as it occurred to him; even the Sun's next-door neighbour, Alpha Centauri, could not have matched the awesome display in any conceivable explosion

The light suddenly dimmed; Sasha had operated the external sun shields. Now it was possible to look directly at the source, and to see that it was a mere pinpoint - just another star, showing no dimensions at all. This could have nothing to do with Jupiter; when Floyd had looked at the planet only a few minutes ago, it had been four times larger than the distant, shrunken sun.

It was well that Sasha had lowered the shields. A moment later, that tiny star exploded - so that even through the dark filters it was impossible to watch

with the naked eye. But the final orgasm of light lasted only a brief fraction of a second; then Jupiter - or what had been Jupiter - was expanding once again.

It continued to expand, until it was far larger than it had been before the transformation. Soon the sphere of light was fading rapidly, down to merely solar brilliance; and presently Floyd could see that it was actually a hollow shell, for the central star was still clearly visible at its heart.

He did a quick mental calculation. The ship was more than one light-minute from Jupiter, yet that expanding shell - now turning into a bright-edged ring - already covered a quarter of the sky. That meant it was coming toward them at - My God! - nearly half the speed of light. Within minutes, it would engulf the ship.

Until then, no one had spoken a word since Sasha's first announcement. Some dangers are so spectacular and so much beyond normal experience that the mind refuses to accept them as real, and watches the approach of doom without any sense of apprehension. The man who looks at the onrushing tidal wave, the descending avalanche, or the spinning funnel of the tornado, yet makes no attempt to flee, is not necessarily paralysed with fright or resigned to an unavoidable fate. He may simply be unable to believe that the message of his eyes concerns him personally. It is all happening to somebody else.

As might have been expected, Tanya was the first to break the spell, with a series of orders that brought Vasili and Floyd hurrying to the bridge.

'What do we do now?' she asked, when they had assembled.

We certainly can't run away, thought Floyd. But perhaps we can improve the odds.

'The'ship's broadside on,' he said. 'Shouldn't we turn away from that thing so we're a smaller target? And get as much of our mass as we can between it and us, to act as a radiation shield?'

Vasili's fingers were already flying over the controls.

'You're right, Woody - though it's already too late as far as any gammas and X rays are concerned. But there may be slower neutrons and alphas and heaven knows what else still on the way.'

The patterns of light began to slide down the walls as the ship turned ponderously on its axis. Presently they vanished completely; Leonov was now oriented so that virtually all its mass lay between the fragile human cargo and the approaching shell of radiation.

Will we actually feel the shock wave, wondered Floyd, or will the expanding gases be too tenuous to have any physical effect by the time they reach us? Seen from the external cameras, the ring of fire now almost encircled the sky. But it was fading rapidly; some of the brighter stars could even be seen shining through it. We're going to live, thought Floyd. We've witnessed the destruction of the greatest of planets - and we've survived.

And presently the cameras showed nothing except stars - even if one was a million times brighter than all the others. The bubble of fire blown by Jupiter had swept harmlessly past them, impressive though it had been. At their distance from the source, only the ship's instruments had recorded its passing.

Slowly, the tension aboard relaxed. As always happens in such circumstances, people started to laugh and to make silly jokes. Floyd scarcely heard them; despite his relief at still being alive, he felt a sense of sadness.

Something great and wonderful had been destroyed. Jupiter, with all its beauty and grandeur and now never-to-be-solved mysteries, had ceased to exist. The father of all the gods had been struck down in his prime.

Yet there was another way of looking at the situation. They had lost Jupiter: What had they gained in its place?

Tanya, judging her moment nicely, rapped for attention.

'Vasili - any damage?'

'Nothing serious - one camera burned out. All radiation meters still well above normal, but none near danger limits.'

'Katerina - check the total dosage we've received. It looks as if we were lucky, unless there are more surprises. We certainly owe a vote of thanks to Bowman - and to you, Heywood. Do you have any idea what happened?'

'Only that Jupiter's turned into a sun.'

'I always thought it was much too small for that. Didn't someone once call Jupiter "the sun that failed"?'

'That's true,' said Vasili, 'Jupiter is too small for fusion to start - unaided.'

'You mean, we've just seen an example of astronomical engineering?'

'Undoubtedly. Now we know what Zagadka was up to.'

'How did it do the trick? If you were given the contract, Vasili, how would you ignite Jupiter?'

Vasili thought for a minute, then shrugged wryly. 'I'm only a theoretical astronomer - I don't have much experience in this line of business. But let's see... Well, if I'm not allowed to add about ten Jupiter masses, or change the gravitational constant, I suppose I'll have to make the planet denser - hmm, that's an idea...'

His voice trailed off into silence; everyone waited patiently, eyes flickering from time to time to the viewing screens.

The star that had been Jupiter seemed to have settled down after its explosive birth; it was now a dazzling point of light, almost equal to the real Sun in apparent brilliance.

'I'm just thinking out loud - but it might be done this way. Jupiter is - was - mostly hydrogen. If a large percentage could be converted into much denser material - who knows, even neutron matter? - that would drop down to the core. Maybe that's what the billions of Zagadkas were doing with all the gas they were sucking in. Nucleosynthesis - building up higher elements from pure hydrogen.

That would be a trick worth knowing! No more shortage of any metal - gold as cheap as aluminium!'

'But how would that explain what happened?' asked Tanya.

'When the core became dense enough, Jupiter would collapse - probably in a matter of seconds. The temperature would rise high enough to start fusion. Oh, I can see a dozen objections - how would they get past the iron minimum; what about radiative transfer; Chandrasekhar's limit. Never mind. This theory will do to start with; I'll work out the details later. Or I'll think of a better one.'

'I'm sure you will, Vasili,' Floyd agreed. 'But there's a more important question. Why did they do it?'

'A warning?' ventured Katerina over the ship's intercom.

'Against what?'

'We'll find that out later.'

'I don't suppose,' said Zenia diffidently, 'that it was an accident?'

That brought the discussion to a dead halt for several seconds.

'What a terrifying idea!' said Floyd. 'But I think we can rule it out. If that was the case, there'd have been no warn - Perhaps. If you start a forest fire because you've been careless, at least you do your best to warn everyone.'

'And there's another thing we'll probably never know,' lamented Vasili. 'I always hoped Carl Sagan would be right, and there'd be life on Jupiter.'

'Our probes never saw any.'

'What chance did they have? Would you find any life on Earth, if you looked at a few hectares of the Sahara or the Antarctic? That's about all we ever did on Jupiter.'

'Hey!' said Brailovsky. 'What about Discovery - and Hal?' Sasha switched on the long-range receiver and started to search on the beacon frequency. There was no trace of a signal.

After a while, he announced to the silently waiting group:

'Discovery's gone.'

No one looked at Dr Chandra; but there were a few muted words of sympathy, as if in consolation to a father who had just lost a son.

But Hal had one last surprise for them.

The radio message beamed to Earth must have left Discovery only minutes before the blast of radiation engulfed the ship. It was in plain text and merely repeated over and over again:

ALL THESE WORLDS ARE YOURS - EXCEPT EUROPA.

ATTEMPT NO LANDINGS THERE.

There were about a hundred repetitions; then the letters became garbled, and the transmission ceased.

'I begin to understand,' said Floyd, when the message had been relayed by an awed and anxious Mission Control.

'That's quite a parting present - a new sun, and the planets around it.'

'But why only three?' asked Tanya.

'Let's not be greedy,' Floyd replied. 'I can think of one very good reason. We know there's life on Europa. Bowman - or his friends, whoever they may be - want us to leave it alone.'

'That makes good sense in another way,' said Vasili. 'I've been doing some calculations. Assuming that Sol 2 has settled down and will continue to radiate at its present level, Europa should have a nice tropical climate - when the ice has melted. Which it's doing pretty quickly right now.'

'What about the other moons?'

'Ganymede will be quite pleasant - the dayside will be temperate. Callisto will be very cold; though if there's much outgassing, the new atmosphere may make it habitable. But Io will be even worse than it is now, I expect.'

'No great loss. It was hell even before this happened.'

'Don't write off Io,' said Curnow. 'I know a lot of Texarab oilmen who'd love to tackle it, just on general principles. There must be something valuable, in a place as nasty as that. And by the way, I've just had a rather disturbing thought.'

'Anything that disturbs you must be serious,' said Vasili. 'What is it?'

'Why did Hal send that message to Earth, and not to us? We were much closer.'

There was a rather long silence; then Floyd said thoughtfully: 'I see what you mean. Perhaps he wanted to make certain it was received on Earth.'

'But he knew we would relay it - oh!' Tanya's eyes widened, as if she had just become aware of something unpleasant.

'You've lost me,' complained Vasili.

'I think this is what Walter's driving at,' said Floyd. 'It's all very well to feel grateful to Bowman - or whatever gave that warning. But that's all they did. We could still have been killed.'

'But we weren't,' answered Tanya. 'We saved ourselves - by our own efforts. And perhaps that was the whole idea. If we hadn't - we wouldn't have been worth saving. You know, survival of the fittest. Darwinian selection. Eliminating the genes for stupidity.'

'I've an unpleasant feeling you're right,' said Curnow. 'And if we'd stuck to our launch date, and not used Discovery as a booster, would it, or they, have done anything to save us? That wouldn't have required much extra effort for an intelligence that could blow up Jupiter.'

There was an uneasy silence, broken at last by Heywood Floyd.

'On the whole,' he said, 'I'm very glad that's one question we'll never get answered.'

54

Between Suns

The Russians, thought Floyd, are going to miss Walter's songs and wisecracks on the way home. After the excitement of the last few days, the long fall Sunward - and Earthward - will seem a monotonous anticlimax. But a monotonous, uneventful trip was what everyone devoutly hoped for.

He was already feeling sleepy, but was still aware of his surroundings and capable of reacting to them. Will I look as dead when I'm in hibernation? he asked himself. It was always disconcerting to look at another person - especially someone very familiar - when he had entered the long sleep.

Perhaps it was too poignant a reminder of one's own mortality.

Curnow was completely out, but Chandra was still awake, though already groggy from the final injection. He was obviously no longer himself, for he seemed quite unperturbed by his own nakedness or Katerina's watchful presence. The gold lingam that was his only article of clothing kept trying to float away from him, until its chain recaptured it.

'Everything going okay, Katerina?' asked Floyd.

'Perfectly. But how I envy you. In twenty minutes, you'll be home.'

'If that's any consolation - how can you be sure we won't have some horrible dreams?'

'No one's ever reported any.'

'Ah - they may forget them when they wake up.'

Katerina, as usual, took him quite seriously. 'Impossible. If there were dreams in hibernation, the EEG records would have revealed them. Okay, Chandra - close your eyes. Ah - there he goes. Now it's your turn, Heywood. The ship will seem very strange without you.'

'Thanks, Katerina... hope you have a nice trip.'

Drowsy though he was, Floyd became aware that Surgeon-Commander Rudenko seemed a little uncertain, even - could it be? - shy. It looked as if she wanted to tell him something, but couldn't make up her mind.

'What is it, Katerina?' he said sleepily.

'I haven't told anyone else yet - but you certainly won't be talking. Here's a little surprise.'

'You'd... better... hurry...'

'Max and Zenia are going to get married.'

'That... is... supposed... to... be... a... surprise?...'

'No. It's just to prepare you. When we get back to Earth, so are Walter and I. What do you think of that?'

Now I understand why you were spending so much time together. Yes, it is indeed a surprise... who would have thought it!

'I'm... very... happy... to... hear...'

Floyd's voice faded out before he could complete the sentence. But he was not yet unconscious, and was still able to focus some of his dissolving intellect on this new situation.

I really don't believe it, he said to himself. Walter will probably change his mind before he wakes up.

And then he had one final thought, just before he went to sleep himself. If Walter does change his mind, he'd better not wake up.

Dr Heywood Floyd thought that was very funny. The rest of the crew often wondered why he was smiling all the way back to Earth.

55

Lucifer Rising

Fifty times more brilliant than the full Moon, Lucifer had transformed the skies of Earth, virtually banishing night for months at a time. Despite its sinister connotations, the name was inevitable; and indeed 'Light-bringer' had brought evil as well as good. Only the centuries and the millennia would show in which direction the balance tilted.

On the credit side, the end of night had vastly extended the scope of human activity, especially in the less-developed countries. Everywhere, the need for artificial lighting had been substantially reduced, with resulting huge savings in electrical power. It was as if a giant lamp had been hoisted into space, to shine upon half the globe. Even in daytime Lucifer was a dazzling object, casting distinct shadows.

Farmers, mayors; city managers, police, seamen, and almost all those engaged in outdoor activities - especially in remote areas - welcomed Lucifer; it had made their lives much safer and easier. But it was hated by lovers, criminals, naturalists, and astronomers.

The first two groups found their activities seriously restricted, while naturalists were concerned about Lucifer's impact upon animal life. Many nocturnal creatures had been seriously affected, while others had managed to adapt. The Pacific grunion, whose celebrated mating pattern was locked to high tides and moonless nights, was in grave trouble, and seemed to be heading for rapid extinction.

And so, it seemed, were Earth-based astronomers. That was not such a scientific catastrophe as it would once have been, for more than fifty per cent of astronomical research depended upon instruments in space or on the Moon. They could be easily shielded from Lucifer's glare; but terrestrial observatories were seriously inconvenienced by the new sun in what had once been the night sky.

The human race would adapt, as it had done to so many changes in the past. A generation would soon be born that had never known a world without Lucifer; but that brightest of all stars would be an eternal question to every thinking man and woman.

Why had Jupiter been sacrificed - and how long would the new sun radiate? Would it burn out quickly, or would it maintain its power for thousands of years- perhaps for the lifetime of the human race? Above all, why the interdiction upon Europa, a world now as cloud-covered as Venus?

There must be answers to those questions; and Mankind would never be satisfied until it had found them.

Epilogue: 20,001

And because, in all the Galaxy, they had found nothing more precious than Mind, they encouraged its dawning everywhere. They became farmers in the fields of stars; they sowed, and sometimes they reaped. And sometimes, dispassionately, they had to weed.

Only during the last few generations have the Europans ventured into the Farside, beyond the light and warmth of their never-setting sun, into the wilderness where the ice that once covered all their world may still be found. And even fewer have remained there to face the brief and fearful night that comes, when the brilliant but powerless Cold Sun sinks below the horizon.

Yet already, those few hardy explorers have discovered that the Universe around them is stranger than they ever imagined. The sensitive eyes they developed in the dim oceans still serve them well; they can see the stars and the other bodies moving in their sky. They have begun to lay the foundations of astronomy, and some daring thinkers have, even surmised that the great world of Europa is not the whole of creation.

Very soon after they had emerged from the ocean, during the explosively swift evolution forced upon them by the melting of the ice, they had realized that the objects in the sky fell into three distinct classes. Most important, of course, was the sun. Some legends - though few took them seriously - claimed that it had not always been there, but had appeared suddenly, heralding a brief, cataclysmic age of transformation, when much of Europa's teeming life had been destroyed. If that was indeed true, it was a small price to pay for the benefits that poured down from the tiny, inexhaustible source of energy that hung unmoving in the sky.

Perhaps the Cold Sun was its distant brother, banished for some crime and condemned to march forever around the vault of heaven. It was of no importance except to those peculiar Europans who were always asking questions about matters that all sensible folk took for granted.

Still, it must be admitted that those cranks had made some interesting discoveries during their excursions into the darkness of Farside. They claimed - though this was hard to believe - that the whole sky was sprinkled with uncountable myriads of tiny lights, even smaller and feebler than the Cold Sun. They varied greatly in brilliance; and though they rose and set, they never moved from their fixed positions.

Against this background, there were three objects that did move, apparently obeying complex laws that no one had yet been able to fathom. And unlike all the others in the sky, they were quite large - though both shape and size varied continually. Sometimes they were disks, sometimes half-circles, sometimes slim crescents. They were obviously closer than all the other bodies in the Universe, for their surfaces showed an immense wealth of complex and ever-changing detail.

The theory that they were indeed other worlds had at last been accepted - though no one except a few fanatics believed that they could be anything like as large, or as important, as Europa. One lay toward the Sun, and was in a constant state of turmoil. On its nightside could be seen the glow of great fires - a phenomenon still beyond the understanding of the Europans, for their atmosphere, as yet, contains no oxygen. And sometimes vast explosions hurl clouds of debris up from the surface; if the sunward globe is indeed a world, it must be a very unpleasant place to live. Perhaps even worse than the nightside of Europa.

The two outer, and more distant, spheres seem to be much less violent places, yet in some ways they are even more mysterious. When darkness falls upon their surfaces, they too show patches of light, but these are very different from the swiftly changing fires of the turbulent inner world. They burn with an almost steady brilliance, and are concentrated in a few small areas - though over the generations, these areas have grown, and multiplied.

But strangest of all are the lights, fierce as tiny suns, that can often be observed moving across the darkness between these other worlds. Once, recalling the bioluminescence of their own seas, some Europans had speculated that these might indeed be living creatures; but their intensity makes that almost

incredible. Nevertheless, more and more thinkers believe that these lights - the fixed patterns, and moving suns - must be some strange manifestation of life.

Against this, however, there is one very potent argument. If they are living things, why do they never come to Europa?

Yet there are legends. Thousands of generations ago, soon after the conquest of the land, it is said that some of those lights came very close indeed - but they always exploded in sky-filling blasts that far outshone the Sun. And strange, hard metals rained down upon the land; some of them are still worshipped to this day.

None is as holy, though, as the huge, black monolith that stands on the frontier of eternal day, one side forever turned to the unmoving Sun, the other facing into the land of night. Ten times the height of the tallest Europan - even when he raises his tendrils to the fullest extent - it is the very symbol of mystery and unattainability. For it has never been touched; it can only be worshipped from afar. Around it lies the Circle of Power, which repels all who try to approach.

It is that same power, many believe, that keeps at bay those moving lights in the sky. If it ever fails, they will descend upon the virgin continents and shrinking seas of Europa, and their purpose will be revealed at last.

The Europans would be surprised to know with what intensity and baffled wonder that black monolith is also studied by the minds behind those moving lights. For centuries now their automatic probes have made a cautious descent from orbit - always with the same disastrous result. For until the time is ripe, the monolith will permit no contact.

When that time comes - when, perhaps, the Europans have invented radio and discovered the messages continually bombarding them from so close at hand - the monolith may change its strategy. It may - or it may not - choose to release the entities who slumber within it, so that they can bridge the gulf between the Europans and the race to which they once held allegiance.

And it may be that no such bridge is possible, and that two such alien forms of consciousness can never coexist. If this is so, then only one of them can inherit the Solar System.

Which it will be, not even the Gods know - yet.

Acknowledgements

My first thanks, of course, must go to Stanley Kubrick, who a rather long time ago wrote to ask if I had any ideas for the 'proverbial good science-fiction movie'.

Next, my appreciation to my friend and agent (the two are not always synonymous) Scott Meredith, for perceiving that a ten-page movie outline I sent

him as an intellectual exercise had rather wider possibilities, and that I owed it to posterity, etc., etc.

Other thanks are due to:

Señor Jorge Luiz Calife of Rio de Janeiro, for a letter which started me thinking seriously about a possible sequel (after I'd said for years that one was clearly impossible).

Dr Bruce Murray, past Director of the Jet Propulsion Laboratory, Pasadena, and Dr Frank Jordan, also of JPL, for computing the Lagrange-1 position in the Io-Jupiter system. Oddly enough, I had made identical calculations thirty-four years earlier for the colinear Earth-Moon Lagrange points ('Stationary Orbits', Journal of the British Astronomical Association, December 1947) but I no longer trust my ability to solve quintic equations, even with the help of HAL, Jr., my trusty H/P 91OOA.

New American Library and Hutchinson & Co., publishers of 2001: A Space Odyssey, for permission to use the material in Chapter 51 (Chapter 37 of 2001: A Space Odyssey) and also quotations in Chapters 30 and 40.

General Potter, US Army Corps of Engineers, for finding time in his busy schedule to show me around EPCOT in 1969 - when it was only a few large holes in the ground.

Wendell Solomons, for help with Russian (and Russlish).

Jean-Michel Jarre, Vangelis, and the incomparable John Williams, for inspiration whenever it was needed.

C. P. Cavafy for 'Waiting for the Barbarians'.

While writing this book, I discovered that the concept of refuelling on Europa had been discussed in a paper, 'Outer planet satellite return missions using in situ propellant production', by Ash, Stancati, Niehoff, and Cuda (Acta Astronautica VIII, 5-6, May-June 1981).

The idea of automatically exponentiating systems (von Neumann machines) for extraterrestrial mining has been seriously developed by von Tiesenhausen and Darbro at NASA's Marshall Space Flight Center (see 'Self-Replicating Systems' - NASA Technical Memorandum 78304). If anyone doubts the power of such systems to cope with Jupiter, I refer them to the study showing how self-replicating factories could cut production time for a solar power collector from 60,000 years to a mere twenty.

The startling idea that gas giants might have diamond cores has been seriously put forward by M. Ross and F. Ree of the Lawrence Livermore Laboratory, University of California, for the cases of Uranus and Neptune. It seems to me that anything they can do, Jupiter could do better. De Beers shareholders, please note.

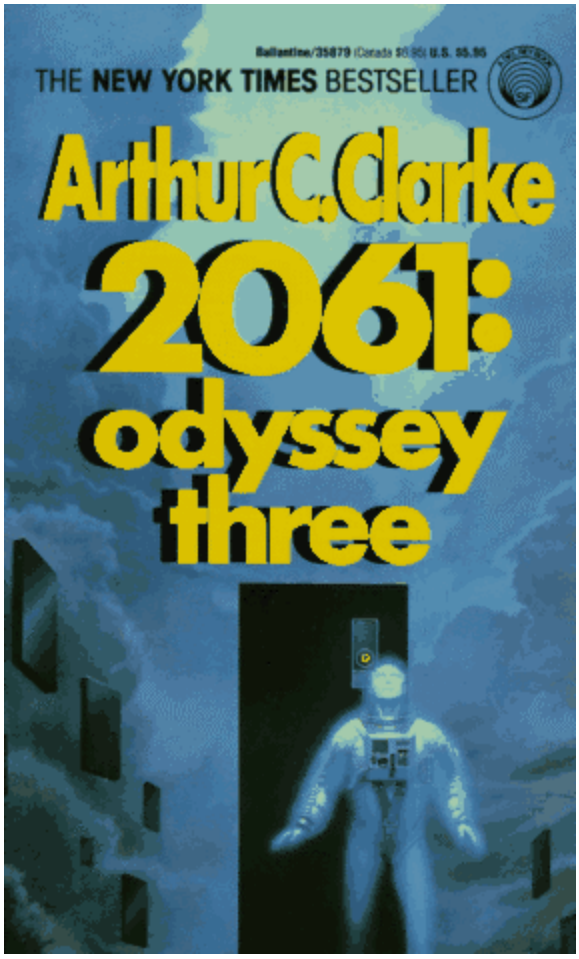
For more details on the aerial life forms that might exist in the Jovian atmosphere, see my story 'A Meeting With Medusa' (in The Wind From the Sun). Such creatures have been beautifully depicted by Adolf Schaller in Part 2 of Carl Sagan's Cosmos ('One Voice in the Cosmic Fugue'), both book and TV series.

The fascinating idea that there might be life on Europa, beneath ice-covered oceans kept liquid by the same Jovian tidal forces that heat Io, was first proposed by Richard C. Hoagland in the magazine Star and Sky ('The Europa Enigma', January 1980). This quite brilliant concept has been taken seriously by a number of astronomers (notably NASA's Institute of Space Studies' Dr Robert Jastrow), and may provide one of the best motives for the projected GALILEO Mission.

And finally: Valerie and Hector, for providing the life-support system;
Cherene, for punctuating every chapter with sticky kisses;
Steve, for being here.

COLOMBO, SRI LANKA
JULY 1981-MARCH 1982

This book was written on an Archives III microcomputer with Word Star software and sent from Colombo to New York on one five-inch diskette. Last-minute corrections were transmitted through the Padukka Earth Station and the Indian Ocean Intelsat V.



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Author: Arthur C. Clarke
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Genre: science fiction

TO THE MEMORY OF
JUDY-LYNN DEL REY,
EDITOR EXTRAORDINARY,
WHO BOUGHT THIS BOOK FOR ONE DOLLAR
- BUT NEVER KNEW IF SHE GOT HER MONEY'S WORTH

Author's Note

Just as 2010: Odyssey Two was not a direct sequel to 2001: A Space Odyssey, so this book is not a linear sequel to 2010. They must all be considered as variations on the same theme, involving many of the same characters and situations, but not necessarily happening in the same universe.

Developments since Stanley Kubrick suggested in 1964 (five years before men landed on the Moon!) that we should attempt 'the proverbial good science-fiction

movie' make total consistency impossible, as the later stories incorporate discoveries and events that had not even taken place when the earlier books were written. 2010 was made possible by the brilliantly successful 1979 Voyager flybys of Jupiter, and I had not intended to return to that territory until the results of the even more ambitious Galileo Mission were in.

Galileo would have dropped a probe into the Jovian atmosphere, while spending almost two years visiting all the major satellites. It should have been launched from the space shuttle in May 1986, and would have reached its objective by December 1988. So around 1990 I hoped to take advantage of the flood of new information from Jupiter and its moons...

Alas, the Challenger tragedy eliminated that scenario; Galileo - now sitting in its clean room at the Jet Propulsion Laboratory - must now find another launch vehicle. It will be lucky if it arrives at Jupiter merely seven years behind schedule.

I have decided not to wait.
Colombo, Sri Lanka,
April 1987

I
THE MAGIC MOUNTAIN

1
The Frozen Years

'For a man of seventy, you're in extremely good shape,' remarked Dr Glazunov, looking up from the Medcom's final print-out. 'I'd have put you down as not more than sixty-five.'

'Happy to hear it, Oleg. Especially as I'm a hundred and three - as you know perfectly well.'

'Here we go again! Anyone would think you've never read Professor Rudenko's book.'

'Dear old Katerina! We'd planned a get-together on her hundredth birthday. I was so sorry she never made it - that's what comes of spending too much time on Earth.'

'Ironic, since she was the one who coined that famous slogan "Gravity is the bringer of old age."'

Dr Heywood Floyd stared thoughtfully at the ever-changing panorama of the beautiful planet, only six thousand kilometres away, on which he could never walk again. It was even more ironic that, through the most stupid accident of his life, he was still in excellent health when virtually all his old friends were dead.

He had been back on Earth only a week when, despite all the warnings and his own determination that nothing of the sort would ever happen to him, he had stepped off that second-storey balcony. (Yes, he had been celebrating: but he had earned it - he was a hero on the new world to which Leonov had returned.) The multiple fractures had led to complications, which could best be handled in the Pasteur Space Hospital.

That had been in 2015. And now - he could not really believe it, but there was the calendar on the wall - it was 2061.

For Heywood Floyd, the biological clock had not merely been slowed down by the one-sixth Earth gravity of the hospital; twice in his life it had actually been reversed. It was now generally believed - though some authorities disputed it - that hibernation did more than merely stop the ageing process; it encouraged rejuvenation. Floyd had actually become younger on his voyage to Jupiter and back.

'So you really think it's safe for me to go?'

'Nothing in this Universe is safe, Heywood. All I can say is that there are no physiological objections. After all, your environment will be virtually the same aboard Universe as it is here. She may not have quite the standard of - ah - superlative medical expertise we can provide at Pasteur, but Dr Mahindran is a good man. If there's any problem he can't cope with, he can put you into hibernation again, and ship you back to us, COD.'

It was the verdict that Floyd had hoped for, yet somehow his pleasure was alloyed with sadness. He would be away for weeks from his home of almost half a century, and the new friends of his later years. And although Universe was a luxury liner compared with the primitive Leonov (now hovering high above Farside as one of the main exhibits at the Lagrange Museum) there was still some element of risk in any extended space voyage. Especially like the pioneering one on which he was now preparing to embark.

Yet that, perhaps, was exactly what he was seeking - even at a hundred and three (or, according to the complex geriatric accounting of the late Professor Katerina Rudenko, a hale and hearty sixty-five.) During the last decade, he had become aware of an increasing restlessness and a vague dissatisfaction with a life that was too comfortable and well-ordered.

Despite all the exciting projects now in progress around the Solar System - the Mars Renewal, the establishment of the Mercury Base, the Greening of Ganymede - there had been no goal on which he could really focus his interests and his still considerable energies. Two centuries ago, one of the first poets of the Scientific Era had summed up his feelings perfectly, speaking through the lips of Odysseus/Ulysses:

Life piled on life

Were all too little, and of one of me

Little remains; but every hour is saved

From that eternal silence, something more,

A bringer of new things: and vile it were

For some three suns to store and hoard myself,

And this grey spirit yearning in desire

To follow knowledge like a sinking star,

Beyond the utmost bound of human thought.

'Three suns', indeed! It was more than forty:

Ulysses would have been ashamed of him. But the next verse - which he knew so well - was even more appropriate:

It may be that the gulfs will wash us down:

It may be we shall touch the Happy Isles,

And see the great Achilles, whom we knew.

Though much is taken, much abides; and though

We are not now that strength which in old days

Moved earth and heaven; that which we are, we are;

One equal temper of heroic hearts,

Made weak by time and fate, but strong in will

To strive, to seek, to find, and not to yield.

'To seek, to find...' Well, now he knew what he was going to seek, and to find - because he knew exactly where it would be. Short of some catastrophic accident, there was no way in which it could possibly elude him.

It was not a goal he had ever consciously had in mind, and even now he was not quite sure why it had become so suddenly dominant. He would have thought himself immune to the fever which was once again infecting mankind - for the second time in his life! - but perhaps he was mistaken. Or it could have been that the unexpected invitation to join the short list of distinguished guests aboard Universe had fired his imagination, and awakened an enthusiasm he had not even known he possessed.

There was another possibility. After all these years, he could still remember what an anticlimax the 1985/6 encounter had been to the general public. Now was a chance - the last for him, and the first for humanity - to more than make up for any previous disappointment.

Back in the twentieth century, only flybys had been possible. This time, there would be an actual landing, as pioneering in its way as Armstrong's and Aldrin's first steps on the Moon.

Dr Heywood Floyd, veteran of the 2010-15 mission to Jupiter, let his imagination fly outwards to the ghostly visitor once again returning from the deeps of space, gaining speed second by second as it prepared to round the Sun. And between the orbits of Earth and Venus the most famous of all comets would meet the still uncompleted space-liner Universe, on her maiden flight.

The exact point of rendezvous was not yet settled, but his decision was already made.

'Halley - here I come...' whispered Heywood Floyd.

2
First Sight

It is not true that one must leave Earth to appreciate the full splendour of the heavens. Not even in space is the starry sky more glorious than when viewed from a high mountain, on a perfectly clear night, far from any source of artificial illumination. Even though the stars appear brighter beyond the atmosphere, the eye cannot really appreciate the difference; and the overwhelming spectacle of half the celestial sphere at a single glance is something that no observation window can provide.

But Heywood Floyd was more than content with his private view of the Universe, especially during the times when the residential zone was on the shadow side of the slowly revolving space hospital. Then there would be nothing in his rectangular field of view but stars, planets, nebulae - and occasionally, drowning out all else, the unblinking glare of Lucifer, new rival to the Sun.

About ten minutes before the beginning of his artificial night, he would switch off all the cabin lights - even the red emergency standby - so that he could become completely dark-adapted. A little late in life for a space engineer, he had learned the pleasures of naked-eye astronomy, and could now identify virtually any constellation, even if he could glimpse only a small portion of it.

Almost every 'night' that May, as the comet was passing inside the orbit of Mars, he had checked its location on the star charts. Although it was an easy object with a good pair of binoculars, Floyd had stubbornly resisted their aid; he was playing a little game, seeing how well his ageing eyes would respond to the challenge. Though two astronomers on Mauna Kea already claimed to have observed the comet visually, no-one believed them, and similar assertions from other residents of Pasteur had been treated with even greater scepticism.

But tonight, a magnitude of at least six was predicted; he might be in luck. He traced the line from Gamma to Epsilon, and stared towards the apex of an imaginary equilateral triangle set upon it - almost as if he could focus his vision across the Solar System by a sheer effort of will.

And there it was! - just as he had first seen it, seventy-six years ago, inconspicuous but unmistakable. If he had not known exactly where to look, he would not even have noticed it, or would have dismissed it as some distant nebula.

To his naked eye it was merely a tiny, perfectly circular blob of mist; strain as he would, he was unable to detect any trace of a tail. But the small flotilla of probes that had been escorting the comet for months had already recorded the first outbursts of dust and gas that would soon create a glowing plume across the stars, pointing directly away from its creator, the Sun,

Like everyone else, Heywood Floyd had watched the transformation of the cold, dark - no, almost black - nucleus as it entered the inner Solar System. After seventy years of deepfreeze, the complex mixture of water, ammonia and other ices was beginning to thaw and bubble. A flying mountain, roughly the shape - and size - of the island of Manhattan was turning on a cosmic spit every fifty-three hours; as the heat of the Sun seeped through the insulating crust, the vaporizing gases were making Halley's Comet behave like a leaking steam-boiler. Jets of water vapour, mixed with dust and a witch's brew of organic chemicals, were bursting out from half a dozen small craters; the largest - about the size of a football field - erupted regularly about two hours after local dawn. It looked exactly like a terrestrial geyser, and had been promptly christened 'Old Faithful'.

Already, he had fantasies of standing on the rim of that crater, waiting for the Sun to rise above the dark, contorted landscape which he already knew well through the images from space. True, the contract said nothing about passengers - as opposed to crew and scientific personnel - going outside the ship when it landed on Halley.

On the other hand, there was also nothing in the small print that specifically forbade it.

They'll have a job to stop me, thought Heywood Floyd. I'm sure I can still handle a spacesuit. And if I'm wrong...

He remembered reading that a visitor to the Taj Mahal had once remarked: 'I'd die tomorrow for a monument like this.'

He would gladly settle for Halley's Comet.

3
Re-entry

Even apart from that embarrassing accident, the return to Earth had not been easy.

The first shock had come soon after revival, when Dr Rudenko had woken him from his long sleep. Walter Curnow was hovering beside her, and even in his semi-conscious state he could tell that something was wrong; their pleasure at seeing him awake was a little too exaggerated, and failed to conceal a sense of strain. Not until he was fully recovered did they let him know that Dr Chandra was no longer with them.

Somewhere beyond Mars, so imperceptibly that the monitors could not pinpoint the time, he had simply ceased to live. His body, set adrift in space, had continued unchecked along Leonov's orbit, and had long since been consumed by the fires of the Sun.

The cause of death was totally unknown, but Max Brailovsky expressed a view that, highly unscientific though it was, not even Surgeon-Commander Katerina Rudenko attempted to refute.

'He couldn't live without Hal.'

Walter Curnow, of all people, added another thought.

'I wonder how Hal will take it?' he asked. 'Something out there must be monitoring all our broadcasts. Sooner or later, he'll know.'

And now Curnow was gone too - so were they all except little Zenia. He had not seen her for twenty years, but her card arrived punctually every Christmas. The last one was still pinned above his desk; it showed a troika laden with gifts speeding through the snows of a Russian winter, watched by extremely hungry-looking wolves.

Forty-five years! Sometimes it seemed only yesterday that Leonov had returned to Earth orbit, and the applause of all mankind. Yet it had been a curiously subdued applause, respectful but lacking genuine enthusiasm. The mission to Jupiter had been altogether too much of a success; it had opened a Pandora's box, the full contents of which had yet to be disclosed.

When the black monolith known as Tycho Magnetic Anomaly One had been excavated on the Moon, only a handful of men knew of its existence. Not until after Discovery's ill-fated voyage to Jupiter did the world learn that, four million years ago, another intelligence had passed through the Solar System, and left its calling card. The news was a revelation - but not a surprise; something of the sort had been expected for decades.

And it had all happened long before the human race existed. Although some mysterious accident had befallen Discovery out round Jupiter, there was no real evidence that it involved anything more than a shipboard malfunction. Although the philosophical consequences of TMA 1 were profound, for all practical purposes mankind was still alone in the Universe.

Now that was no longer true. Only light minutes away - a mere stone's throw in the Cosmos - was an intelligence that could create a star, and, for its own inscrutable purpose, destroy a planet a thousand times the size of Earth. Even more ominous was the fact that it had shown awareness of mankind, through the last message that Discovery had beamed back from the moons of Jupiter just before the fiery birth of Lucifer had destroyed it:

ALL THESE WORLDS ARE YOURS - EXCEPT EUROPA.
ATTEMPT NO LANDINGS THERE.

The brilliant new star, which had banished night except for the few months in each year when it was passing behind the Sun, had brought both hope and fear to mankind. Fear - because the Unknown, especially when it appeared linked with omnipotence - could not fail to rouse such primeval emotions. Hope - because of the transformation it had wrought in global politics.

It had often been said that the only thing that could unite mankind was a threat from space. Whether Lucifer was a threat, no-one knew; but it was certainly a challenge. And that, as it turned out, was enough.

Heywood Floyd had watched the geopolitical changes from his vantage point on Pasteur, almost as if he was an alien observer himself. At first, he had no intention of remaining in space, once his recovery was complete. To the baffled annoyance of his doctors, that took an altogether unreasonable length of time.

Looking back from the tranquillity of later years, Floyd knew exactly why his bones refused to mend.

He simply did not wish to return to Earth: there was nothing for him, down on the dazzling blue and white globe that filled his sky. There were times when he could well understand how Chandra might have lost the will to live.

It was pure chance that he had not been with his first wife on that flight to Europe. Now Marion was part of another life, that might have belonged to someone else, and their two daughters were amiable strangers with families of their own.

But he had lost Caroline through his own actions, even though he had no real choice in the matter. She had never understood (had he really done so himself?) why he had left the beautiful home they had made together, to exile himself for years in the cold wastes far from the Sun.

Though he had known, even before the mission was half over, that Caroline would not wait, he had hoped desperately that Chris would forgive him. But even this consolation had been denied; his son had been without a father for too long. By the time that Floyd returned, he had found another, in the man who had taken his place in Caroline's life. The estrangement was complete; he thought he would never get over it, but of course he did - after a fashion.

His body had cunningly conspired with his unconscious desires. When at last he returned to Earth, after his protracted convalescence in Pasteur, he promptly developed such alarming symptoms - including something suspiciously like bone necrosis - that he was immediately rushed back to orbit. And there he had stayed, apart from a few excursions to the Moon, completely adapted to living in the zero to one-sixth gravity regime of the slowly rotating space hospital.

He was not a recluse - far from it. Even while he was convalescing, he was dictating reports, giving evidence to endless commissions, being interviewed by media representatives. He was a famous man, and enjoyed the experience - while it lasted. It helped to compensate for his inner wounds.

The first complete decade - 2020 to 2030 - seemed to have passed so swiftly that he now found it difficult to focus upon it. There were the usual crises, scandals, crimes, catastrophes - notably the Great Californian Earthquake, whose aftermath he had watched with fascinated horror through the station's monitor screens. Under their greatest magnification, in favourable conditions, they

could show individual human beings; but from his God's-eye-view it had been impossible to identify with the scurrying dots fleeing from the burning cities. Only the ground cameras revealed the true horror.

During that decade, though the results would not be apparent until later, the political tectonic plates were moving as inexorably as the geological ones - yet in the opposite sense, as if time was running backwards. For in the beginning, the Earth had possessed the single supercontinent of Pangaea, which over the aeons had split asunder. So had the human species, into innumerable tribes and nations; now it was merging together, as the old linguistic and cultural divisions began to blur.

Although Lucifer had accelerated the process, it had begun decades earlier, when the coming of the jet age had triggered an explosion of global tourism. At almost the same time - it was not, of course, a coincidence - satellites and fibre optics had revolutionized communications. With the historic abolition of long-distance charges on 31 December 2000, every telephone call became a local one, and the human race greeted the new millennium by transforming itself into one huge, gossiping family.

Like most families, it was not always a peaceful one, but its disputes no longer threatened the entire planet. The second - and last - nuclear war saw the use in combat of no more bombs than the first: precisely two. And though the kilotonnage was greater, the casualties were far fewer, as both were used against sparsely populated oil installations. At that point the Big Three of China, the US and the USSR moved with commendable speed and wisdom, sealing off the battle zone until the surviving combatants had come to their senses.

By the decade of 2020-30, a major war between the Great Powers was as unthinkable as one between Canada and the United States had been in the century before. This was not due to any vast improvement in human nature, or indeed to any single factor except the normal preference of life over death. Much of the machinery of peace was not even consciously planned: before the politicians realized what had happened, they discovered that it was in place, and functioning well...

No statesman, no idealist of any persuasion invented the 'Peace Hostage' movement; the very name was not coined until well after someone had noticed that at any given moment there were a hundred thousand Russian tourists in the United States - and half a million Americans in the Soviet Union, most of them engaged in their traditional pastime of complaining about the plumbing. And perhaps even more to the point, both groups contained a disproportionately large number of highly non-expendable individuals - the sons and daughters of wealth, privilege and political power.

And even if one wished, it was no longer possible to plan a large-scale war. The Age of Transparency had dawned in the 1990s, when enterprising news media had started to launch photographic satellites with resolutions comparable to those that the military had possessed for three decades. The Pentagon and the Kremlin were furious; but they were no match for Reuters, Associated Press and the unsleeping, twenty-four-hours-a-day cameras of the Orbital News Service.

By 2060, even though the world had not been completely disarmed, it had been effectively pacified, and the fifty remaining nuclear weapons were all under international control. There was surprisingly little opposition when that popular monarch, Edward VIII, was elected the first Planetary President, only a dozen states dissenting. They ranged in size and importance from the still

stubbornly neutral Swiss (whose restaurants and hotels nevertheless greeted the new bureaucracy with open arms) to the even more fanatically independent Malvinians, who now resisted all attempts by the exasperated British and Argentines to foist them off on each other.

The dismantling of the vast and wholly parasitic armaments industry had given an unprecedented - sometimes, indeed, unhealthy - boost to the world economy. No longer were vital raw materials and brilliant engineering talents swallowed up in a virtual black hole - or, even worse, turned to destruction. Instead, they could be used to repair the ravages and neglect of centuries, by rebuilding the world.

And building new ones. Now indeed mankind had found the 'moral equivalent of war', and a challenge that could absorb the surplus energies of the race - for as many millennia ahead as anyone dared to dream.

4
Tycoon

When he was born, William Tsung had been called 'the most expensive baby in the world'; he held the title for only two years before it was claimed by his sister. She still held it, and now that the Family Laws had been repealed, it would never be challenged.

Their father, the legendary Sir Lawrence, had been born when China had re-instituted the stringent 'One Child, One Family' rule; his generation had provided psychologists and social scientists with material for endless studies. Having no brothers or sisters - and in many cases, no uncles or aunts - it was unique in human history. Whether credit was due to the resilience of the species or the merit of the Chinese 'extended family' system would probably never be settled. The fact remained that the children of that strange time were remarkably free from scars; but they were certainly not unaffected, and Sir Lawrence had done his somewhat spectacular best to make up for the isolation of his infancy.

When his second child was born in '22, the licensing system had become law. You could have as many children as you wished, provided only that you paid the appropriate fee. (The surviving old guard communists were not the only ones who thought the whole scheme perfectly appalling, but they were outvoted by their pragmatic colleagues in the fledgling congress of the People's Democratic Republic.)

Numbers one and two were free. Number three cost a million sols. Number four was two million. Number five was four million, and so on. The fact that, in theory, there were no capitalists in the People's Republic was cheerfully ignored.

Young Mr Tsung (that was years, of course, before King Edward gave him his KBE) never revealed if he had any target in mind; he was still a fairly poor millionaire when his fifth child was born. But he was still only forty, and when the purchase of Hong Kong did not take quite as much of his capital as he had feared, he discovered that he had a considerable amount of small change in hand.

So ran the legend - but, like many other stories about Sir Lawrence, it was hard to distinguish fact from mythology. There was certainly no truth in the persistent rumour that he had made his first fortune through the famous shoe-box-sized pirate edition of the Library of Congress. The whole Molecular Memory Module racket was an off-Earth operation, made possible by the United States' failure to sign the Lunar Treaty.

Even though Sir Lawrence was not a multitrillionaire, the complex of corporations he had built up made him the greatest financial power on earth - no small achievement for the son of a humble videocassette peddler in what was still known as the New Territories. He probably never noticed the eight million for Child Number Six, or even the thirty-two for Number Eight. The sixty-four he had to advance on Number Nine attracted world publicity, and after Number Ten the bets placed on his future plans may well have exceeded the two hundred and fifty-six million the next child would have cost him. However, at that point the Lady Jasmine, who combined the best properties of steel and silk in exquisite proportion, decided that the Tsung dynasty was adequately established.

It was quite by chance (if there is such a thing) that Sir Lawrence became personally involved in the space business. He had, of course, extensive maritime and aeronautical interests, but these were handled by his five sons and their associates. Sir Lawrence's real love was communications - newspapers (those few that were left), books, magazines (paper and electronic) and, above all, the global television networks.

Then he had bought the magnificent old Peninsular Hotel, which to a poor Chinese boy had once seemed the very symbol of wealth and power, and turned it into his residence and main office. He surrounded it by a beautiful park, by the simple expedient of pushing the huge shopping centres underground (his newly formed Laser Excavation Corporation made a fortune in the process, and set a precedent for many other cities).

One day, as he was admiring the unparalleled skyline of the city across the harbour, he decided that a further improvement was necessary. The view from the lower floors of the Peninsular had been blocked for decades by a large building looking like a squashed golfball. This, Sir Lawrence decided, would have to go.

The Director of the Hong Kong Planetarium - widely considered to be among the five best in the world - had other ideas, and very soon Sir Lawrence was delighted to discover someone he could not buy at any price. The two men became firm friends; but when Dr Hessenstein arranged a special presentation for Sir Lawrence's sixtieth birthday, he did not know that he would help to change the history of the Solar System.

5
Out of the Ice

More than a hundred years after Zeiss had built the first prototype in Jena in 1924, there were still a few optical planetarium projectors in use, looming dramatically over their audiences. But Hong Kong had retired its third-generation instrument decades ago, in favour of the far more versatile electronic system. The whole of the great dome was, essentially, a giant

television screen, made up of thousands of separate panels, on which any conceivable image could be displayed.

The programme had opened - inevitably - with a tribute to the unknown inventor of the rocket, somewhere in China during the thirteenth century. The first five minutes were a high-speed historical survey, giving perhaps less than due credit to the Russian, German and American pioneers in order to concentrate on the career of Dr Hsue-Shen Tsien. His countrymen could be excused, in such a time and place, if they made him appear as important in the history of rocket development as Goddard, von Braun, or Koroylev. And they certainly had just grounds for indignation at his arrest on trumped-up charges in the United States when, after helping to establish the famed Jet Propulsion Laboratory and being appointed Caltech's first Goddard Professor, he decided to return to his homeland.

The launching of the first Chinese satellite by the 'Long March 1' rocket in 1970 was barely mentioned, perhaps because at that time the Americans were already walking on the Moon. Indeed, the rest of the twentieth century was dismissed in a few minutes, to take the story up to 2007 and the construction of the spaceship Tsien.

The narrator did not gloat unduly over the consternation of the other spacefaring powers, when a presumed Chinese space station suddenly blasted out of orbit and headed for Jupiter, to overtake the Russian-American mission aboard the Cosmonaut Alexei Leonov. The story was dramatic - and tragic - enough to require no embellishment.

Unfortunately, there was very little authentic visual material to illustrate it: the programme had to rely largely on special effects and intelligent reconstruction from later, long-range photo-surveys. During their brief sojourn on the icy surface of Europa, Tsien's crew had been far too busy to make television documentaries, or even set up an unattended camera.

Nevertheless, the words spoken at the time conveyed much of the drama of that first landing on the moons of Jupiter. The commentary broadcast from the approaching Leonov by Heywood Floyd served admirably to set the scene, and there were plenty of library shots of Europa to illustrate it:

'At this very moment I'm looking at it through the most powerful of the ship's telescopes; under this magnification, it's ten times larger than the Moon as you see it with the naked eye. And it's a really weird sight.

'The surface is a uniform pink, with a few small brown patches. It's covered with an intricate network of narrow lines, curling and weaving in all directions. In fact, it looks very much like a photo from a medical textbook, showing a pattern of veins and arteries.

'A few of these features are hundreds - or even thousands - of kilometres long, and look rather like the illusory canals that Percival Lowell and other early-twentieth-century astronomers imagined they'd seen on Mars.

'But Europa's canals aren't an illusion, though of course they're not artificial. What's more, they do contain water - or at least ice. For the satellite is almost entirely covered by ocean, averaging fifty kilometres deep.

'Because it's so far from the Sun, Europa's surface temperature is extremely low - about a hundred and fifty degrees below freezing. So one might expect its single ocean to be a solid block of ice.

'Surprisingly, that isn't the case because there's a lot of heat generated inside Europa by tidal forces - the same forces that drive the great volcanoes on neighbouring Io.

'So the ice is continually melting, breaking up and freezing, forming cracks and lanes like those in the floating ice sheets in our own polar regions. It's that intricate tracery of cracks I'm seeing now; most of them are dark and very ancient - perhaps millions of years old. But a few are almost pure white; they're the new ones that have just opened up, and have a crust only a few centimetres thick.

'Tsien has landed right beside one of these white streaks - the fifteen-hundred-kilometre-long feature that's been christened the Grand Canal. Presumably the Chinese intend to pump its water into their propellant tanks, so that they can explore the Jovian satellite system and then return to Earth. That may not be easy, but they'll certainly have studied the landing site with great care, and must know what they're doing.

'It's obvious, now, why they've taken such a risk - and why they claim Europa. As a refuelling point, it could be the key to the entire Solar System...'

But it hadn't worked out that way, thought Sir Lawrence, as he reclined in his luxurious chair beneath the streaked and mottled disc that filled his artificial sky. The oceans of Europa were still inaccessible to mankind, for reasons which were still a mystery. And not only inaccessible, but invisible: since Jupiter had become a sun, both its inner satellites had vanished beneath clouds of vapour boiling out from their interiors. He was looking at Europa as it had been back in 2010 - not as it was today.

He had been little more than a boy then, but could still remember the pride he felt in knowing that his countrymen - however much he disapproved of their politics - were about to make the first landing on a virgin world.

There had been no camera there, of course, to record that landing, but the reconstruction was superbly done. He could really believe that was the doomed spaceship dropping silently out of the jetblack sky towards the Europan icescape, and coming to rest beside the discoloured band of recently frozen water that had been christened the Grand Canal.

Everyone knew what had happened next; perhaps wisely, there had been no attempt to reproduce it visually. Instead, the image of Europa faded, to be replaced by a portrait as familiar to every Chinese as Yuri Gagarin's was to every Russian.

The first photograph showed Rupert Chang on his graduation day in 1989 - the earnest young scholar, indistinguishable from a million others, utter1y unaware of his appointment with history two decades in the future.

Briefly, to a background of subdued music, the commentator summed up the highlights of Dr Chang's career, until his appointment as Science Officer aboard Tsien. Cross-sections in time, the photographs grew older, until the last one, taken immediately before the mission.

Sir Lawrence was glad of the planetarium's darkness; both his friends and his enemies would have been surprised to see the moisture gathering in his eyes as he listened to the message that Dr Chang had aimed towards the approaching Leonov, never knowing if it would be received.

'... know you are aboard Leonov... may not have much time... aiming my suit antenna where I think...'

The signal vanished for agonizing seconds, then came back much clearer, though not appreciably louder.

'... relay this information to Earth. Tsien destroyed three hours ago. I'm only survivor. Using my suit radio - no idea if it has enough range, but it's the only chance. Please listen carefully. THERE IS LIFE ON EUROPA. I repeat: THERE IS LIFE ON EUROPA...

The signal faded again.

'... soon after local midnight. We were pumping steadily and the tanks were almost half full. Dr Lee and I went out to check the pipe insulation. Tsien stands - stood - about thirty metres from the edge of the Grand Canal. Pipes go directly from it and down through the ice. Very thin - not safe to walk on. The warm upwelling...'

Again a long silence.

'... no problem - five kilowatts of lighting strung up on the ship. Like a Christmas tree - beautiful, shining right through the ice. Glorious colours. Lee saw it first - a huge dark mass rising up from the depths. At first we thought it was a school of fish - too large for a single organism - then it started to break through the ice.

'... like huge strands of wet seaweed, crawling along the ground. Lee ran back to the ship to get a camera - I stayed to watch, reporting over the radio. The thing moved so slowly I could easily outrun it. I was much more excited than alarmed. Thought I knew what kind of creature it was - I've seen pictures of the kelp forests off California - but I was quite wrong...

I could tell it was in trouble. It couldn't possibly survive at a temperature a hundred and fifty below its normal environment. It was freezing solid as it moved forward - bits were breaking off like glass - but it was still advancing towards the ship - a black tidal wave, slowing down all the time.

'I was still so surprised that I couldn't think straight and I couldn't imagine what it was trying to do.

'... climbing up the ship, building a kind of ice tunnel as it advanced. Perhaps this was insulating it from the cold - the way termites protect themselves from Sunlight with their little corridors of mud.

'... tons of ice on the ship. The radio antennas broke off first. Then I could see the landing legs beginning to buckle - all in slow motion, like a dream.

'Not until the ship started to topple did I realize what the thing was trying to do - and then it was too late. We could have saved ourselves - if we'd only switched off those lights.

'Perhaps it's a phototrope, its biological cycle triggered by the Sunlight that filters through the ice. Or it could have been attracted like a moth to a candle. Our floodlights must have been more brilliant than anything that Europa has ever known.

'Then the ship crashed. I saw the hull split, a cloud of snowflakes form as moisture condensed. All the lights went out, except for one, swinging back and forth on a cable a couple of metres above the ground.

'I don't know what happened immediately after that. The next thing I remember, I was standing under the light, beside the wreck of the ship, with a fine powdering of fresh snow all around me. I could see my footsteps in it very clearly... I must have run there; perhaps only a minute or two had elapsed...

'The plant - I still thought of it as a plant - was motionless. I wondered if it had been damaged by the impact; large sections - as thick as a man's arm - had splintered off, like broken twigs.

'Then the main trunk started to move again. It pulled away from the hull, and began to crawl towards me. That was when I knew for certain that the thing was light-sensitive: I was standing immediately under the thousand-watt lamp, which had stopped swinging now.

'Imagine an oak tree - better still, a banyan with its multiple trunks and roots - flattened out by gravity and trying to creep along the ground. It got to within five metres of the light, then started to spread out until it had made a perfect circle around me. Presumably that was the limit of its tolerance -the point at which photo-attraction turned to repulsion. After that, nothing happened for several minutes. I wondered if it was dead - frozen solid at last.

'Then I saw that large buds were forming on many of the branches. It was like watching a time-lapse film of flowers opening. In fact I thought they were flowers - each about as big as a man's head.

'Delicate, beautifully coloured membranes started to unfold. Even then, it occurred to me that no-one - no thing - could ever have seen these colours before; they had no existence until we brought our lights - our fatal lights - to this world.

'Tendrils, stamens, waving feebly... I walked over to the living wall that surrounded me, so that I would see exactly what was happening. Neither then, or at any other time, had I felt the slightest fear of the creature. I was certain that it was not malevolent - if indeed it was conscious at all.

'There were scores of the big flowers, in various stages of unfolding. Now, they reminded me of butterflies, just emerging from the chrysalis... wings crumpled, still feeble... I was getting closer and closer to the truth.

'But they were freezing - dying as quickly as they formed. Then, one after another, they dropped off from the parent buds. For a few moments they flopped around like fish stranded on dry land - and at last I realized exactly what they were. Those membranes weren't petals - they were fins, or their equivalent. This was the free-swimming, larval stage of the creature. Probably it spends much of

its life rooted on the seabed, then sends these mobile offspring in search of new territory. Just like the corals of Earth's oceans.

'I knelt down to get a closer look at one of the little creatures. The beautiful colours were fading now, to a drab brown. Some of the petal-fins had snapped off, becoming brittle shards as they froze. But it was still moving feebly, and as I approached it tried to avoid me. I wondered how it sensed my presence.

'Then I noticed that the stamens - as I'd called them - all carried bright blue dots at their tips. They looked like tiny star sapphires - or the blue eyes along the mantle of a scallop - aware of light, but unable to form true images. As I watched, the vivid blue faded, the sapphires became dull, ordinary stones...

'Dr Floyd - or anyone else who is listening - I haven't much more time - Jupiter will soon block my signal. But I've almost finished.

'I knew then what I had to do. The cable to that thousand-watt lamp was hanging almost to the ground. I gave it a few tugs, and the light went out in a shower of sparks.

'I wondered if it was too late. For a few minutes, nothing happened. So I walked over to the wall of tangled branches around me, and kicked it.

'Slowly, the creature started to unweave itself, and to retreat back to the Canal. There was plenty of light - I could see everything perfectly. Ganymede and Callisto were in the sky - Jupiter was a huge, thin crescent - and there was a big auroral display on the nightside, at the Jovian end of the Io flux tube. There was no need to use my helmet light.

'I followed the creature all the way back to the water, encouraging it with more kicks when it slowed down, feeling the fragments of ice crunching all the time beneath my boots... As it neared the Canal, it seemed to gain strength and energy, as if it knew that it was approaching its natural home. I wondered if it would survive, to bud again.

'It disappeared through the surface, leaving a few last dead larvae on the alien land. The exposed free water bubbled for a few minutes until a scab of protective ice sealed it from the vacuum above. Then I walked back to the ship to see if there was anything to salvage - I don't want to talk about that...

'I've only two requests to make, Doctor. When the taxonomists classify this creature, I hope they'll name it after me.

'And - when the next ship comes home - ask them to take our bones back to China..

'Jupiter will be cutting us off in a few minutes. I wish I knew whether anyone was receiving me. Anyway, I'll repeat this message when we're in line of sight again - if my suit's life-support system lasts that long.

'This is Professor Chang on Europa, reporting the destruction of spaceship Tsien. We landed beside the Grand Canal and set up our pumps at the edge of the ice...'

The signal faded abruptly, came back for a moment, then disappeared completely below the noise level. There would never be any further message from Professor Chang; but it had already deflected Lawrence Tsung's ambitions into space.

6
The Greening of Ganymede

Rolf van der Berg was the right man, in the right place, at the right time; no other combination would have worked. Which, of course, is how much of history is made.

He was the right man because he was a second-generation Afrikaner refugee, and a trained geologist; both factors were equally important. He was in the right place, because that had to be the largest of the Jovian moons - third outwards in the sequence Io, Europa, Ganymede, Callisto.

The time was not so critical, for the information had been ticking away like a delayed-action bomb in the data banks for at least a decade. Van der Berg did not encounter it until '57; even then it took him another year to convince himself that he was not crazy - and it was '59 before he had quietly sequestered the original records so that no-one could duplicate his discovery. Only then could he safely give his full attention to the main problem: what to do next.

It had all begun, as is so often the case, with an apparently trivial observation in a field which did not even concern van der Berg directly. His job, as a member of the Planetary Engineering Task Force, was to survey and catalogue the natural resources of Ganymede; he had little business fooling around with the forbidden satellite next door.

But Europa was an enigma which no-one - least of all its immediate neighbours - could ignore for long. Every seven days it passed between Ganymede and the brilliant minisun that had once been Jupiter, producing eclipses which could last as long as twelve minutes. At its closest, it appeared slightly smaller than the Moon as seen from Earth, but it dwindled to a mere quarter of that size when it was on the other side of its orbit.

The eclipses were often spectacular. Just before it slid between Ganymede and Lucifer, Europa would become an ominous black disc, outlined with a ring of crimson fire, as the light of the new sun was refracted through the atmosphere it had helped to create.

In less than half a human lifetime, Europa had been transformed. The crust of ice on the hemisphere always facing Lucifer had melted, to form the Solar System's second ocean. For a decade it had foamed and bubbled into the vacuum above it, until equilibrium had been reached. Now Europa possessed a thin but serviceable - though not to human beings - atmosphere of water vapour, hydrogen sulphide, carbon and sulphur dioxides, nitrogen, and miscellaneous rare gases. Though the somewhat misnamed 'nightside' of the satellite was still permanently frozen, an area as large as Africa now had a temperate climate, liquid water, and a few scattered islands.

All this, and not much more, had been observed through telescopes in Earth orbit. By the time that the first full-scale expedition had been launched to the Galilean moons, in 2028, Europa had already become veiled by a permanent mantle of clouds. Cautious radar probing revealed little but smooth ocean on one face, and almost equally smooth ice on the other; Europa still maintained its reputation as the flattest piece of real estate in the Solar System. Ten years later, that was no longer true: something drastic had happened to Europa. It now possessed a solitary mountain, almost as high as Everest, jutting up through the ice of the twilight zone. Presumably some volcanic activity - like that occurring ceaselessly on neighbouring Io - had thrust this mass of material skywards. The vastly increased heat-flow from Lucifer could have triggered such an event.

But there were problems with this obvious explanation. Mount Zeus was an irregular pyramid, not the usual volcanic cone, and radar scans showed none of the characteristic lava flows. Some poor-quality photographs obtained through telescopes on Ganymede, during a momentary break in the clouds, suggested that it was made of ice, like the frozen landscape around it. Whatever the answer, the creation of Mount Zeus had been a traumatic experience for the world it dominated, for the entire crazy-paving pattern of fractured ice floes over the nightside had changed completely.

One maverick scientist had put forward the theory that Mount Zeus was a 'cosmic iceberg' - a cometary fragment that had dropped upon Europa from space; battered Callisto gave ample proof that such bombardments had occurred in the remote past. The theory was very unpopular on Ganymede, whose would-be colonists already had sufficient problems.

They had been much relieved when van der Berg had refuted the theory convincingly; any mass of ice this size would have shattered on impact - and even if it hadn't, Europa's gravity, modest though it was, would have quickly brought about its collapse. Radar measurements showed that though Mount Zeus was indeed steadily sinking, its overall shape remained completely unaltered. Ice was not the answer.

The problem could, of course, have been settled by sending a single probe through the clouds of Europa. Unfortunately, whatever was beneath that almost permanent overcast did not encourage curiosity.

ALL THESE WORLDS ARE YOURS - EXCEPT EUROPA.
ATTEMPT NO LANDINGS THERE.

That last message relayed from the spaceship Discovery just before its destruction had not been forgotten, but there had been endless arguments about its interpretation. Did 'landings' refer to robot probes, or only to manned vehicles? And what about close flybys - manned or unmanned? Or balloons floating in the upper atmosphere?

The scientists were anxious to find out, but the general public was distinctly nervous. Any power that could detonate the mightiest planet in the Solar System was not to be trifled with. And it would take centuries to explore and exploit Io, Ganymede, Callisto and the dozens of minor satellites; Europa could wait.

More than once, therefore, van der Berg had been told not to waste his valuable time on research of no practical importance, when there was so much to be done on Ganymede. ('Where can we find carbon - phosphorus - nitrates for the hydroponic farms? How stable is the Barnard Escarpment? Is there any danger of more mudslides in Phrygia?' And so on and so forth...) But he had inherited his Boer ancestors' well-deserved reputation for stubbornness: even when he was working on his numerous other projects, he kept looking over his shoulder at Europa.

And one day, just a few hours, a gale from the nightside cleared the skies about Mount Zeus.

7
Transit

'I too take leave of all 1 ever had...'

From what depths of memory had that line come swimming up to the surface? Heywood Floyd closed his eyes, and tried to focus on the past. It was certainly from a poem - and he had hardly read a line of poetry since leaving college. And little enough then, except during a short English Appreciation Seminar.

With no further clues, it might take the station computer quite a while - perhaps as much as ten minutes - to locate the line in the whole body of English literature. But that would be cheating (not to mention expensive) and Floyd preferred to accept the intellectual challenge.

A war poem, of course - but which war? There had been so many in the twentieth century.

He was still searching through the mental mists when his guests arrived, moving with the effortless, slow-motion grace of longtime one-sixth gravity residents. The society of Pasteur was strongly influenced by what had been christened 'centrifugal stratification'; some people never left the zero gee of the hub, while those who hoped one day to return to Earth preferred the almost normal-weight regime out on the rim of the huge, slowly revolving disc.

George and Jerry were now Floyd's oldest and closest friends - which was surprising, because they had so few obvious points in common. Looking back on his own somewhat chequered emotional career - two marriages, three formal contracts, two informal ones, three children - he often envied the long-term stability of their relationship, apparently quite unaffected by the 'nephews' from Earth or Moon who visited them from time to time.

'Haven't you ever thought of divorce?' he had once asked them teasingly.

As usual, George - whose acrobatic yet profoundly serious conducting had been largely responsible for the comeback of the classical orchestra - was at no loss for words.

'Divorce - never,' was his swift reply. 'Murder - often.'

'Of course, he'd never get away with it,' Jerry had retorted. 'Sebastian would spill the beans.'

Sebastian was a beautiful and talkative parrot which the couple had imported after a long battle with the hospital authorities. He could not only talk, but could reproduce the opening bars of the Sibelius Violin Concerto, with which Jerry - considerably helped by Antonio Stradivari - had made his reputation half a century ago.

Now the time had come to say goodbye to George, Jerry and Sebastian - perhaps only for a few weeks, perhaps for ever. Floyd had already made all his other farewells, in a round of parties that had gravely depleted the station's wine cellar, and could think of nothing he had left undone.

Archie, his early-model but still perfectly serviceable comsec, had been programmed to handle all incoming messages, either by sending out appropriate replies or by routing anything urgent and personal to him aboard Universe. It would be strange, after all these years, not to be able to talk to anyone he wished - though in compensation he could also avoid unwanted callers. After a few days into the voyage, the ship would be far enough from Earth to make real-time conversation impossible, and all communication would have to be by recorded voice or teletext.

'We thought you were our friend,' complained George. 'It was a dirty trick to make us your executors - especially as you're not going to leave us anything.'

'You may have a few surprises,' grinned Floyd. 'Anyway, Archie will take care of all the details. I'd just like you to monitor my mail, in case there's anything he doesn't understand.'

'If he won't, nor will we. What do we know about all your scientific societies and that sort of nonsense?'

'They can look after themselves. Please see that the cleaning staff doesn't mess things up too badly while I'm away - and, if I don't come back - here are a few personal items I'd like delivered - mostly family.'

Family! There were pains, as well as pleasures, in living as long as he had done.

It had been sixty-three - sixty-three! - years since Marion had died in that air crash. Now he felt a twinge of guilt, because he could not even recall the grief he must have known. Or at best, it was a synthetic reconstruction, not a genuine memory.

What would they have meant to each other, had she still been alive? She would have been just a hundred years old by now.

And now the two little girls he had once loved so much were friendly, grey-haired strangers in their late sixties, with children - and grandchildren! - of their own. At last count there had been nine on that side of the family; without Archie's help, he would never be able to keep track of their names. But at least they all remembered him at Christmas, through duty if not affection.

His second marriage, of course, had overlain the memories of his first, like the later writing on a medieval palimpsest. That too had ended, fifty years ago,

somewhere between Earth and Jupiter. Though he had hoped for a reconciliation with both wife and son, there had been time for only one brief meeting, among all the welcoming ceremonies, before his accident exiled him to Pasteur.

The meeting had not been a success; nor had the second, arranged at considerable expense and difficulty aboard the space hospital itself - indeed, in this very room. Chris had been twenty then, and had just married; if there was one thing that united Floyd and Caroline, it was disapproval of his choice.

Yet Helena had turned out remarkably well: she had been a good mother to Chris II, born barely a month after the marriage. And when, like so many other young wives, she was widowed by the Copernicus Disaster, she did not lose her head.

There was a curious irony in the fact that both Chris I and II had lost their fathers to space, though in very different ways. Floyd had returned briefly to his eight-year-old son as a total stranger; Chris II had at least known a father for the first decade of his life, before losing him for ever.

And where was Chris these days? Neither Caroline nor Helena - who were now the best of friends - seemed to know whether he was on Earth or in space. But that was typical; only postcards date-stamped CLAVIUS BASE had informed his family of his first visit to the Moon.

Floyd's card was still taped prominently above his desk. Chris II had a good sense of humour - and of history. He had mailed his grandfather that famous photograph of the Monolith, looming over the spacesuited figures gathered round it in the Tycho excavation, more than half a century ago. All the others in the group were now dead, and the Monolith itself was no longer on the Moon. In 2006, after much controversy, it had been brought to Earth and erected - an uncanny echo of the main building - in the United Nations Plaza. It had been intended to remind the human race that it was no longer alone; five years later, with Lucifer blazing in the sky, no such reminder was needed.

Floyd's fingers were not very steady - sometimes his right hand seemed to have a will of its own - as he unpeeled the card and slipped it into his pocket. It would be almost the only personal possession he would take when he boarded Universe.

'Twenty-five days - you'll be back before we've noticed you're gone,' said Jerry. 'And by the way, is it true that you'll have Dimitri onboard?'

'That little Cossack!' snorted George. 'I conducted his Second Symphony, back in '22.'

'Wasn't that when the First Violin threw up, during the largo?'

'No - that was Mahler, not Mihailovich. And anyway it was the brass, so nobody noticed - except the unlucky tuba player, who sold his instrument the next day.'

'You're making this up!'

'Of course. But give the old rascal my love, and ask him if he remembers that night we had out in Vienna. Who else have you got aboard?'

'I've heard horrible rumours about press gangs,' said Jerry thoughtful1y.

'Greatly exaggerated, I can assure you. We've all been personally chosen by Sir Lawrence for our intelligence, wit, beauty, charisma, or other redeeming virtue.'

'Not expendability?'

'Well, now that you mention it, we've all had to sign a depressing legal document, absolving Tsung Spacelines from every conceivable liability. My copy's in that file, by the way.'

'Any chance of us collecting on it?' asked George hopefully.

'No - my lawyers say it's iron-clad. Tsung agrees to take me to Halley and back, give me food, water, air, and a room with a view.'

'And in return?'

'When I get back I'll do my best to promote future voyages, make some video appearances, write a few articles - all very reasonable, for the chance of a lifetime. Oh yes - I'll also entertain my fellow passengers - and vice versa.'

'How? Song and dance?'

'Well, I hope to inflict selected portions of my memoirs on a captive audience. But I don't think I'll be able to compete with the professionals. Did you know that Yva Merlin will be on board?'

'What! How did they coax her out of that Park Avenue cell?'

'She must be a hundred and - oops, sorry, Hey.' 'She's seventy, plus or minus five.'

'Forget the minus. I was just a kid when Napoleon came out.'

There was a long pause while each of the trio scanned his memories of that famous work. Although some critics considered her Scarlett O'Hara to be her finest role, to the general public Yva Merlin (née Evelyn Miles, when she was born in Cardiff, South Wales) was still identified with Josephine. Almost half a century ago, David Griffin's controversial epic had delighted the French and infuriated the British - though both sides now agreed that he had occasionally allowed his artistic impulses to trifle with the historical record, notably in the spectacular final sequence of the Emperor's coronation in Westminster Abbey.

'That's quite a scoop for Sir Lawrence,' said George thoughtfully.

'I think I can claim some credit for that. Her father was an astronomer - he worked for me at one time - and she's always been quite interested in science. So I made a few video calls.'

Heywood Floyd did not feel it necessary to add that, like a substantial fraction of the human race, he had fallen in love with Yva ever since the appearance of GWTW Mark II.

'Of course,' he continued, 'Sir Lawrence was delighted - but I had to convince him that she had more than a casual interest in astronomy. Otherwise the voyage could be a social disaster.'

'Which reminds me,' said George, producing a small package he had been not very successfully hiding behind his back. 'We have a little present for you.'

'Can I open it now?'

'Do you think he should?' Jerry wondered anxiously.

'In that case, I certainly will,' said Floyd, untying the bright green ribbon and unwrapping the paper.

Inside was a nicely framed painting. Although Floyd knew little of art, he had seen it before; indeed, who could ever forget it?

The makeshift raft tossing on the waves was crowded with half-naked castaways, some already moribund, others waving desperately at a ship on the horizon. Beneath it was the caption:

THE RAFT OF THE MEDUSA
(Theodore Géricault, 1791-1824)

And underneath that was the message, signed by George and Jerry: 'Getting there is half the fun.'

'You're a pair of bastards, and I love you dearly,' said Floyd, embracing them both. The ATTENTION light on Archie's keyboard was flashing briskly; it was time to go.

His friends left in a silence more eloquent than words. For the last time, Heywood Floyd looked around the little room that had been his universe for almost half his life.

And suddenly he remembered how that poem ended:

'I have been happy: happy now I go.'

8
Starfleet

Sir Lawrence Tsung was not a sentimental man, and was far too cosmopolitan to take patriotism seriously - though as an undergraduate he had briefly sported one of the artificial pigtails worn during the Third Cultural Revolution. Yet the planetarium re-enactment of the Tsien disaster moved him deeply, and caused him to focus much of his enormous influence and energy upon space.

Before long, he was taking weekend trips to the Moon, and had appointed his son Charles (the thirty-two-million-so! one) as Vice-President of Tsung

Astrofreight. The new corporation had only two catapult-launched, hydrogen-fuelled ramrockets of less than a thousand tons empty mass; they would soon be obsolete, but they could provide Charles with the experience that, Sir Lawrence was quite certain, would be needed in the decades ahead. For at long last, the Space Age was truly about to begin.

Little more than half a century had separated the Wright Brothers and the coming of cheap, mass air transportation; it had taken twice as long to meet the far greater challenge of the Solar System.

Yet when Luis Alvarez and his team had discovered muon-catalysed fusion back in the 1950s, it had seemed no more than a tantalizing laboratory curiosity, of only theoretical interest. Just as the great Lord Rutherford had pooh-poohed the prospects of atomic power, so Alvarez himself doubted that 'cold nuclear fusion' would ever be of practical importance. Indeed, it was not until 2040 that the unexpected and accidental manufacture of stable muonium-hydrogen 'compounds' had opened up a new chapter of human history - exactly as the discovery of the neutron had initiated the Atomic Age.

Now small, portable nuclear power plants could be built, with a minimum of shielding. Such enormous investments had already been made in conventional fusion that the world's electrical utilities were not - at first - affected, but the impact on space travel was immediate; it could be paralleled only by the jet revolution in air transport of a hundred years earlier.

No longer energy-limited, spacecraft could achieve far greater speeds; flight times in the Solar System could now be measured in weeks rather than months or even years. But the muon drive was still a reaction device - a sophisticated rocket, no different in principle from its chemically fuelled ancestors; it needed a working fluid to give it thrust. And the cheapest, cleanest, and most convenient of all working fluids was - plain water.

The Pacific Spaceport was not likely to run short of this useful substance. Matters were different at the next port of call - the Moon. Not a trace of water had been discovered by the Surveyor, Apollo, and Luna missions. If the Moon had ever possessed any native water, aeons of meteoric bombardment had boiled and blasted it into space.

Or so the selenologists believed; yet clues to the contrary had been visible, ever since Galileo had turned his first telescope upon the Moon. Some lunar mountains, for a few hours after dawn, glitter as brilliantly as if they are capped with snow. The most famous case is the rim of the magnificent crater Aristarchus, which William Herschel, the father of modem astronomy, once observed shining so brightly in the lunar night that he decided it must be an active volcano. He was wrong; what he saw was the Earthlight reflected from a thin and transient layer of frost, condensed during the three hundred hours of freezing darkness.

The discovery of the great ice deposits beneath Schroter's Valley, the sinuous canyon winding away from Anstarchus, was the last factor in the equation that would transform the economics of space-flight. The Moon could provide a filling station just where it was needed, high up on the outermost slopes of the Earth's gravitational field, at the beginning of the long haul to the planets.

Cosmos, first of the Tsung fleet, had been designed to carry freight and passengers on the Earth-Moon-Mars run, and as a test-vehicle, through complex deals with a dozen organizations and governments, of the still experimental muon

drive. Built at the Imbriurn shipyards, she had just sufficient thrust to lift off from the Moon with zero payload; operating from orbit to orbit, she would never again touch the surface of any world. With his usual flair for publicity, Sir Lawrence arranged for her maiden flight to commence on the hundredth anniversary of Sputnik Day, 4 October 2057.

Two years later, Cosmos was joined by a sister ship. Galaxy was designed for the Earth-Jupiter run, and had enough thrust to operate directly to any of the Jovian moons, though at considerable sacrifice of payload. If necessary, she could even return to her lunar berth for refitting. She was by far the swiftest vehicle ever built by man: if she burned up her entire propellant mass in one orgasm of acceleration, she would attain a speed of a thousand kilometres a second - which would take her from Earth to Jupiter in a week, and to the nearest star in not much more than ten thousand years.

The third ship of the fleet - and Sir Lawrence's pride and joy - embodied all that had been learned in the building of her two sisters. But Universe was not intended primarily for freight. She was designed from the beginning as the first passenger liner to cruise the space lanes - right out to Saturn, the jewel of the Solar System.

Sir Lawrence had planned something even more spectacular for her maiden voyage, but construction delays caused by a dispute with the Lunar Chapter of the Reformed Teamsters' Union had upset his schedule. There would just be time for the initial flight tests and Lloyd's certification in the closing months of 2060, before Universe left Earth orbit for her rendezvous. It would be a very close thing: Halley's Comet would not wait, even for Sir Lawrence Tsung.

9
Mount Zeus

The survey satellite Europa VI had been in orbit for almost fifteen years, and had far exceeded its design life; whether it should be replaced was a subject of considerable debate in the small Ganymede scientific establishment.

It carried the usual collection of data-gathering instruments, as well as a now virtually useless imaging system. Though still in perfect working order, all that this normally showed of Europa was an unbroken cloudscape. The overworked science team on Ganymede scanned the recordings in 'Quick Look' mode once a week, then squirted the raw data back to Earth. On the whole, they would be rather relieved when Europa VI expired and its torrent of uninteresting gigabytes finally dried up.

Now, for the first time in years, it had produced something exciting.

'Orbit 71934,' said the Deputy Chief Astronomer, who had called van der Berg as soon as the latest data-dump had been evaluated. 'Coming in from the nightside - heading straight for Mount Zeus. You won't see anything for another ten seconds, though.'

The screen was completely black, yet van der Berg could imagine the frozen landscape rolling past beneath its blanket of clouds a thousand kilometres below. In a few hours the distant Sun would be shining there, for Europa

revolved on its axis once in every seven Earth-days. 'Nightside' should really be called 'Twilight-side', for half the time it had ample light - but no heat. Yet the inaccurate name had stuck, because it had emotional validity: Europa knew Sunrise, but never Lucifer-rise.

And the Sunrise was coming now, speeded up a thousandfold by the racing probe. A faintly luminous band bisected the screen, as the horizon emerged from darkness.

The explosion of light was so sudden that van der Berg could almost imagine he was looking into the glare of an atomic bomb. In a fraction of a second, it ran through all the colours of the rainbow, then became pure white as the Sun leapt above the mountain - then vanished as the automatic filters cut into the circuit.

'That's all; pity there was no operator on duty at the time - he could have panned the camera down and had a good view of the mountain as we went over. But I knew you'd like to see it - even though it disproves your theory.'

'How?' said van der Berg, more puzzled than annoyed.

'When you go through it in slow motion, you'll see what I mean. Those beautiful rainbow effects - they're not atmospheric - they're caused by the mountain itself. Only ice could do that. Or glass - which doesn't seem very likely.'

'Not impossible - volcanoes can produce natural glass - but it's usually black... of course!'

'Yes?'

'Er - I won't commit myself until I've been through the data. But my guess would be rock crystal - transparent quartz. You can make beautiful prisms and lenses out of it. Any chance of some more observations?'

'I'm afraid not - that was pure luck - Sun, mountain, camera all lined up at the right time. It won't happen again in a thousand years.'

'Thanks, anyway - can you send me over a copy? No hurry - I'm just leaving on a field trip to Perrine, and won't be able to look at it until I get back.'

Van der Berg gave a short, rather apologetic laugh.

'You know, if that really is rock crystal, it would be worth a fortune. Might even help solve our balance of payments problem...'

But that, of course, was utter fantasy. Whatever wonders - or treasures - Europa might conceal, the human race had been forbidden access to them, by that last message from Discovery. Fifty years later, there was no sign that the interdiction would ever be lifted.

For the first forty-eight hours of the voyage, Heywood Floyd could not really believe the comfort, the spaciousness - the sheer extravagance of Universe's living arrangements. Yet most of his fellow passengers took them for granted; those who had never left Earth before assumed that all spaceships must be like this.

He had to look back at the history of aeronautics to put matters in the right perspective. In his own lifetime, he had witnessed - indeed, experienced - the revolution that had occurred in the skies of the planet now dwindling behind him. Between the clumsy old Leonov and the sophisticated Universe lay exactly fifty years. (Emotionally, he couldn't really believe that - but it was useless arguing about arithmetic.)

And just fifty years had separated the Wright Brothers from the first jet airliners. At the beginning of that half-century, intrepid aviators had hopped from field to field, begoggled and windswept on open chairs; at its end, grandmothers had slumbered peacefully between continents at a thousand kilometres an hour.

So he should not, perhaps, have been astonished at the luxury and elegant decor of his stateroom, or even the fact that he had a steward to keep it tidy. The generously sized window was the most startling feature of his suite, and at first he felt quite uncomfortable thinking of the tons of air pressure it was holding in check against the implacable, and never for a moment relaxing, vacuum of space.

The biggest surprise, even though the advance literature should have prepared him for it, was the presence of gravity. Universe was the first spaceship ever built to cruise under continuous acceleration, except for the few hours of the mid-course 'turnaround'. When her huge propellant tanks were fully loaded with their five thousand tons of water, she could manage a tenth of a gee - not much, but enough to keep loose objects from drifting around. This was particularly convenient at mealtimes - though it took a few days for the passengers to learn not to stir their soup too vigorously.

Forty-eight hours out from Earth, the population of Universe had already stratified itself into four distinct classes.

The aristocracy consisted of Captain Smith and his officers. Next came the passengers; then crew - non-commissioned and stewards. And then steerage...

That was the description that the five young space scientists had adopted for themselves, first as a joke but later with a certain amount of bitterness. When Hoyd compared their cramped and jury-rigged quarters with his own luxurious cabin, he could see their point of view, and soon became the conduit of their complaints to the Captain.

Yet all things considered, they had little to grumble about; in the rush to get the ship ready, it had been touch and go as to whether there would be any accommodation for them and their equipment. Now they could look forward to deploying instruments around - and on - the comet during the critical days before it rounded the Sun, and departed once more to the outer reaches of the Solar System. The members of the science team would establish their reputations on this voyage, and knew it. Only in moments of exhaustion, or fury with misbehaving instrumentation, did they start complaining about the noisy

ventilating system, the claustrophobic cabins, and occasional strange smells of unknown origin.

But never the food, which everyone agreed was excellent. 'Much better,' Captain Smith assured them, 'than Darwin had on the Beagle.'

To which Victor Willis had promptly retorted:

'How does he know? And by the way, Beagle's commander cut his throat when he got back to England.'

That was rather typical of Victor, perhaps the planet's best-known science communicator - to his fans - or 'pop-scientist' - to his equally numerous detractors. It would be unfair to call them enemies; admiration for his talents was universal, if occasionally grudging. His soft, mid-Pacific accent and expansive gestures on camera were widely parodied, and he had been credited (or blamed) for the revival of full-length beards. 'A man who grows that much hair,' critics were fond of saying, 'must have a lot to hide.'

He was certainly the most instantly recognizable of the six VIPs - though Floyd, who no longer regarded himself as a celebrity, always referred to them ironically as 'The Famous Five'. Yva Merlin could often walk unrecognized on Park Avenue, on the rare occasions when she emerged from her apartment. Dimitri Mihailovich, to his considerable annoyance, was a good ten centimetres below average height; this might help to explain his fondness for thousand-piece orchestras - real or synthesized -but did not enhance his public image.

Clifford Greenburg and Margaret M'Bala also fell into the category of 'famous unknowns' - though this would certainly change when they got back to Earth. The first man to land on Mercury had one of those pleasant, unremarkable faces that are very hard to remember; moreover the days when he had dominated the news were now thirty years in the past. And like most authors who are not addicted to talk shows and autographing sessions, Ms M'Bala would be unrecognized by the vast majority of her millions of readers.

Her literary fame had been one of the sensations of the forties. A scholarly study of the Greek pantheon was not usually a candidate for the best-seller lists, but Ms M'Bala had placed its eternally inexhaustible myths in a contemporary space-age setting. Names which a century earlier had been familiar only to astronomers and classical scholars were now part of every educated person's world picture; almost every day there would be news from Ganymede, Callisto, Io, Titan, Japetus - or even more obscure worlds like Carme, Pasiphaë, Hyperion, Phoebe...

Her book would have been no more than modestly successful, however, had she not focused on the complicated family life of Jupiter-Zeus, Father of all the Gods (as well as much else). And by a stroke of luck, an editor of genius had changed her original title, The View from Olympus, to The Passions of the Gods. Envious academics usually referred to it as Olympic Lusts, but invariably wished they had written it.

Not surprisingly, it was Maggie M - as she was quickly christened by her fellow passengers - who first used the phrase Ship of Fools. Victor Willis adopted it eagerly, and soon discovered an intriguing historical resonance. Almost a century ago, Katherine Anne Porter had herself sailed with a group of scientists and writers aboard an ocean liner to watch the launch of Apollo 17, and the end of the first phase of lunar exploration.

'I'll think about it,' Ms M'Bala had remarked ominously, when this was reported to her. 'Perhaps it's time for a third version. But I won't know, of course, until we get back to Earth...'

11
The Lie

It was many months before Rolf van der Berg could once again turn his thoughts and energies towards Mount Zeus. The taming of Ganymede was a more than full-time job, and he was away from his main office at Dardanus Base for weeks at a time, surveying the route of the proposed Gilgamesh-Osiris monorail.

The geography of the third and largest Galilean moon had changed drastically since the detonation of Jupiter - and it was still changing. The new sun that had melted the ice of Europa was not as powerful here, four hundred thousand kilometres further out - but it was warm enough to produce a temperate climate at the centre of the face forever turned towards it. There were small, shallow seas - some as large as Earth's Mediterranean - up to latitudes forty north and south. Not many features still survived from the maps generated by the Voyager missions back in the twentieth century. Melting permafrost and occasional tectonic movements triggered by the same tidal forces operating on the two inner moons made the new Ganymede a cartographer's nightmare.

But those very factors also made it a planetary engineer's paradise. Here was the only world, except for the arid and much less hospitable Mars, on which men might one day walk unprotected beneath an open sky. Ganymede had ample water, all the chemicals of life, and - at least while Lucifer shone - a warmer climate than much of Earth.

Best of all, full-body spacesuits were no longer necessary; the atmosphere, though still unbreathable, was just dense enough to permit the use of simple face-masks and oxygen cylinders. In a few decades - so the microbiologists promised, though they were hazy about specific dates - even these could be discarded. Strains of oxygen-generating bacteria had already been let loose across the face of Ganymede; most had died but some had flourished, and the slowly rising curve on the atmospheric analysis chart was the first exhibit proudly displayed to all visitors at Dardanus.

For a long time, van der Berg kept a watchful eye on the data flowing in from Europa VI, hoping that one day the clouds would clear again when it was orbiting above Mount Zeus. He knew that the odds were against it, but while the slightest chance existed he made no effort to explore any other avenue of research. There was no hurry, he had far more important work on his hands - and anyway, the explanation might turn out to be something quite trivial and uninteresting.

Then Europa VI suddenly expired, almost certainly as a result of a random meteoric impact. Back on Earth, Victor Willis had made rather a fool of himself - in the opinion of many - by interviewing the 'Euronuts' who now more than adequately filled the gap left by the UFO-enthusiasts of the previous century. Some of them argued that the probe's demise was due to hostile action from the world below: the fact that it had been allowed to operate without interference

for fifteen years - almost twice its design life - did not bother them in the least. To Victor's credit, he stressed this point and demolished most of the cultists' other arguments; but the consensus was that he should never have given them publicity in the first place.

To van der Berg, who quite relished his colleagues' description of him as a 'stubborn Dutchman' and did his best to live up to it, the failure of Europa VI was a challenge not to be resisted. There was not the slightest hope of funding a replacement, for the silencing of the garrulous and embarrassingly long-lived probe had been received with considerable relief.

So what was the alternative? Van der Berg sat down to consider his options. Because he was a geologist, and not an astrophysicist, it was several days before he suddenly realized that the answer had been staring him in the face ever since he had landed on Ganymede.

Afrikaans is one of the world's best languages in which to curse; even when spoken politely, it can bruise innocent bystanders. Van der Berg let off steam for a few minutes; then he put through a call to the Tiamat Observatory - sitting precisely on the equator, with the tiny, blinding disc of Lucifer forever vertically overhead.

Astrophysicists, concerned with the most spectacular objects in the Universe, tend to patronize mere geologists who devote their lives to small, messy things like planets. But out here on the frontier, everyone helped everyone else, and Dr Wilkins was not only interested but sympathetic.

The Tiamat Observatory had been built for a single purpose, which had indeed been one of the main reasons for establishing a base on Ganymede. The study of Lucifer was of enormous importance not only to pure scientists but also to nuclear engineers, meteorologists, oceanographers - and, not least, to statesmen and philosophers. That there were entities which could turn a planet into a sun was a staggering thought, and had kept many awake at night. It would be well for mankind to learn all it could about the process; one day there might be need to imitate it - or prevent it.

And so for more than a decade Tiamat had been observing Lucifer with every possible type of instrumentation, continually recording its spectrum across the entire electromagnetic band, and also actively probing it with radar from a modest hundred-metre dish, slung across a small impact crater.

'Yes,' said Dr Wilkins, 'we've often looked at Europa and Io. But our beam is fixed on Lucifer, so we can only see them for a few minutes while they're in transit. And your Mount Zeus is just on the dayside, so it's hidden from us then.'

'I realize that,' said van der Berg a little impatiently. 'But couldn't you offset the beam by just a little, so you could have a look at Europa before it comes in line? Ten or twenty degrees would get you far enough into dayside.'

'One degree would be enough to miss Lucifer, and get Europa full-face on the other side of its orbit. But then it would be more than three times further away, so we'd only have a hundredth of the reflected power. Might work, though: we'll give it a try. Let me have the specs on frequencies, wave envelopes, polarization and anything else your remote-sensing people think will help. It

won't take us long to rig up a phase-shifting network that will slew the beam a couple of degrees. More than that I don't know - it's not a problem we've ever considered. Though perhaps we should have done so - anyway, what do you expect to find on Europa, except ice and water?'

'If I knew,' said van der Berg cheerfully, 'I wouldn't be asking for help, would I?'

'And I wouldn't be asking for full credit when you publish. Too bad my name's at the end of the alphabet; you'll be ahead of me by only one letter.'

That was a year ago: the long-range scans hadn't been good enough, and offsetting the beam to look on to Europa's dayside just before conjunction had proved more difficult than expected. But at last the results were in; the computers had digested them, and van der Berg was the first human being to look at a mineralogical map of post-Lucifer Europa.

It was, as Dr Wilkins had surmised, mostly ice and water, with outcroppings of basalt interspersed with deposits of sulphur. But there were two anomalies.

One appeared to be an artefact of the imaging process; there was an absolutely straight feature, two kilometres long, which showed virtually no radar echo. Van der Berg left Dr Wilkins to puzzle over that; he was only concerned with Mount Zeus.

It had taken him a long time to make the identification, because only a madman - or a really desperate scientist - would have dreamed that such a thing was possible. Even now, though every parameter checked to the limits of accuracy, he still could not really believe it. And he had not even attempted to consider his next move.

When Dr Wilkins called, anxious to see his name and reputation spreading through the data banks, he mumbled that he was still analysing the results. But at last he could put it off no longer.

'Nothing very exciting,' he told his unsuspecting colleague. 'Merely a rare form of quartz - I'm still trying to match it from Earth samples.'

It was the first time he had ever lied to a fellow scientist, and he felt terrible about it.

But what was the alternative?

12
Oom Paul

Rolf van der Berg had not seen his Uncle Paul for a decade, and it was not likely that they would ever again meet in the flesh. Yet he felt very close to the old scientist - the last of his generation, and the only one who could recall (when he wished, which was seldom) his forefathers' way of life.

Dr Paul Kreuger - 'Oom Paul' to all his family and most of his friends - was always there when he was needed, with information and advice, either in person

or at the end of a half-billion-kilometre radio link. Rumour had it that only extreme political pressure had forced the Nobel Committee - with great reluctance - to overlook his contributions to particle physics, now once more in desperate disarray after the general house-cleaning at the end of the twentieth century.

If this was true, Dr Kreuger bore no grudge. Modest and unassuming, he had no personal enemies, even among the cantankerous factions of his fellow exiles. Indeed, he was so universally respected that he had received several invitations to re-visit the United States of Southern Africa, but had always politely declined - not, he hastened to explain, because he felt he would be in any physical danger in the USSA, but because he feared that the sense of nostalgia would be overwhelming.

Even using the security of a language now understood by less than a million people, van der Berg had been very discreet, and had used circumlocutions and references that would be meaningless except to a close relative. But Paul had no difficulty in understanding his nephew's message, though he could not take it seriously. He was afraid young Rolf had made a fool of himself, and would let him down as gently as possible. Just as well he hadn't rushed to publish: at least he had the sense to keep quiet...

And suppose - just suppose - it was true? The scanty hairs rose on the back of Paul's head. A whole spectrum of possibilities - scientific, financial, political - suddenly opened up before his eyes, and the more he considered them, the more awesome they appeared.

Unlike his devout ancestors, Dr Kreuger had no God to address in moments of crisis or perplexity. Now, he almost wished he had; but even if he could pray, that wouldn't really help. As he sat down at his computer and started to access the data banks, he did not know whether to hope that his nephew had made a stupendous discovery - or was talking utter nonsense. Could the Old One really play such an incredible trick on mankind? Paul remembered Einstein's famous comment that though He was subtle, He was never malicious.

Stop daydreaming, Dr Paul Kreuger told himself. Your likes or dislikes, your hopes or fears, have absolutely nothing to do with the matter.

A challenge had been flung to him across half the width of the Solar System; he would not know peace until he had uncovered the truth.

13
'No-one told us to bring swimsuits...'

Captain Smith kept his little surprise until day five, just a few hours before turnaround. His announcement was received, as he had expected, with stunned incredulity.

Victor Willis was the first to recover.

'A swimming pool! In a spaceship! You must be joking!'

The Captain leaned back and prepared to enjoy himself. He grinned at Heywood Floyd who had already been let into the secret.

'Well, I suppose Columbus would have been amazed at some of the facilities on the ships that came after him.'

'Is there a diving board?' asked Greenburg wistfully. 'I used to be college champion.'

'As a matter of fact - yes. It's only five metres - but that will give you three seconds of free fall, at our nominal tenth of a gee. And if you want a longer time, I'm sure Mr Curtis will be happy to reduce thrust.'

'Indeed?' said the Chief Engineer dryly. 'And mess up all my orbit calculations? Not to mention the risk of the water crawling out, Surface tension, you know...

'Wasn't there a space station once that had a spherical swimming pool?' somebody asked.

'They tried it at the hub of Pasteur, before they started the spin,' answered Floyd. 'It just wasn't practical. In zero gravity, it had to be completely enclosed. And you could drown rather easily inside a big sphere of water, if you panicked.'

'One way of getting into the record books - first person to drown in space...'

'No-one told us to bring swimsuits,' complained Maggie M'Bala.

'Anyone who has to wear a swimsuit probably should,' Mihailovich whispered to Floyd.

Captain Smith rapped on the table to restore order. 'This is more important, please. As you know, at midnight we reach maximum speed, and have to start braking. So the drive will shut down at 23.00, and the ship will be reversed. We'll have two hours of weightlessness before we commence thrust again at 01.00.

'As you can imagine, the crew will be rather busy - we'll use the opportunity for an engine check and a hull inspection, which can't be done while we're under power. I strongly advise you to be sleeping then, with the restraint straps lightly fastened across your beds. The stewards will check that there aren't any loose articles that could cause trouble when weight comes on again. Questions?'

There was a profound silence, as if the assembled passengers were still somewhat stunned by the revelation and were deciding what to do about it.

'I was hoping you'd ask me about the economics of such a luxury - but as you haven't, I'll tell you anyway. It's not a luxury at all - it doesn't cost a thing, but we hope it will be a very valuable asset on future voyages.

'You see, we have to carry five thousand tons of water as reaction mass, so we might as well make the best use of it. Number One tank is now three-quarters empty; we'll keep it that way until the end of the voyage. So after breakfast tomorrow - see you down at the beach...

Considering the rush to get Universe spaceborne, it was surprising that such a good job had been done on something so spectacularly non-essential.

The 'beach' was a metal platform, about five metres wide, curving around a third of the great tank's circumference. Although the far wall was only another twenty metres away, clever use of projected images made it seem at infinity. Borne on the waves in the middle distance, surfers were heading towards a shore which they would never reach, Beyond them, a beautiful passenger clipper which any travel agent would recognize instantly as Tsung Sea-Space Corporation's Tai-Pan was racing along the horizon under a full spread of sail.

To complete the illusion, there was sand underfoot (slightly magnetized, so it would not stray too far from its appointed place) and the short length of beach ended in a grove of palm trees which were quite convincing, until examined too closely. Overhead, a hot tropical sun completed the idyllic picture; it was hard to realize that just beyond these walls the real Sun was shining, now twice as fiercely as on any terrestrial beach.

The designer had really done a wonderful job, in the limited space available. It seemed a little unfair of Greenburg to complain: 'Pity there's no surf...'

14
Search

It is a good principle in science not to believe any 'fact' - however well-attested - until it fits into some accepted frame of reference. Occasionally, of course, an observation can shatter the frame and force the construction of a new one, but that is extremely rare. Galileos and Einsteins seldom appear more than once per century, which is just as well for the equanimity of mankind.

Dr Kreuger fully accepted this principle: he would not believe his nephew's discovery until he could explain it, and as far as he could see that required nothing less than a direct Act of God. Wielding Occam's still highly serviceable razor, he thought it somewhat more probable that Rolf had made a mistake; if so, it should be fairly easy to find it.

To Uncle Paul's great surprise, it proved very difficult indeed. The analysis of radar remote-sensing observations was now a venerable and well-established art, and the experts that Paul consulted all gave the same answer, after considerable delay. They also asked: 'Where did you get that recording?'

'Sorry,' he had answered. 'I'm not at liberty to say.'

The next step was to assume that the impossible was correct, and to start searching the literature. This could be an enormous job, for he did not even know where to begin. One thing was quite certain: a brute-force, head-on attack was bound to fail. It would be just as if Roentgen, the morning after he had discovered X-rays, had started to hunt for their explanation in the physics journals of his day. The information he needed still lay years in the future.

But there was at least a sporting chance that what he was looking for was hidden somewhere in the immense body of existing scientific knowledge. Slowly and carefully, Paul Kreuger set up an automatic search programme, designed for what it would exclude as much as what it would embrace. It should cut out all Earth-related references - they would certainly number in the millions - and concentrate entirely on extraterrestrial citations.

One of the benefits of Dr Kreuger's eminence was an unlimited computer budget: that was part of the fee he demanded from the various organizations who needed his wisdom. Though this search might be expensive, he did not have to worry about the bill.

As it turned out, this was surprisingly small. He was lucky: the search came to an end after only two hours thirty-seven minutes, at the 21,456th reference.

The title was enough. Paul was so excited that his own comsec refused to recognize his voice, and he had to repeat the command for a full print-out.

Nature had published the paper in 1981 - almost five years before he was born! - and as his eyes swept swiftly over its single page he knew not only that his nephew had been right all along - but, just as important, exactly how such a miracle could occur.

The editor of that eighty-year-old journal must have had a good sense of humour. A paper discussing the cores of the outer planets was not something to grab the usual reader: this one, however, had an unusually striking title. His comsec could have told him quickly enough that it had once been part of a famous song, but that of course was quite irrelevant.

Anyway, Paul Kreuger had never heard of the Beatles, and their psychedelic fantasies.

II
THE VALLEY OF THE BLACK SNOW

15
Rendezvous

And now Halley was too close to be seen; ironically, observers back on Earth would get a far better view of the tail, already stretching fifty million kilometres at right angles to the comet's orbit, like a pennant fluttering in the invisible gale of the solar wind.

On the morning of the rendezvous, Heywood Floyd woke early from a troubled sleep. It was unusual for him to dream - or at least to remember his dreams - and doubtless the anticipated excitements of the next few hours were responsible. He was also slightly worried by a message from Caroline, asking if he had heard from Chris lately. He had radioed back, a little tersely, that Chris had never bothered to say thank you when he had helped him get his current

position on Universe's sister ship Cosmos; perhaps he was already bored with the Earth-Moon run and was looking for excitement elsewhere.

'As usual,' Floyd had added, 'we'll hear from him in his own good time.'

Immediately after breakfast, passengers and science team had gathered for a final briefing from Captain Smith. The scientists certainly did not need it, but if they felt any irritation, so childish an emotion would have been quickly swept away by the weird spectacle on the main viewscreen.

It was easier to imagine that Universe was flying into a nebula, rather than a comet. The entire sky ahead was now a misty white fog - not uniform, but mottled with darker condensations and streaked with luminous bands and brightly glowing jets, all radiating away from a central point. At this magnification, the nucleus was barely visible as a tiny black speck, yet it was clearly the source of all the phenomena around it.

'We cut our drive in three hours,' said the Captain. 'Then we'll be only a thousand kilometres away from the nucleus, with virtually zero velocity. We'll make some final observations, and confirm our landing site.'

'So we'll go weightless at 12.00 exactly. Before then, your cabin stewards will check that everything's correctly stowed. It will be just like turnaround, except that this time it's going to be three days, not two hours, before we have weight again.

'Halley's gravity? Forget it - less than one centimetre per second squared - just about a thousandth of Earth's. You'll be able to detect it if you wait long enough, but that's all. Takes fifteen seconds for something to fall a metre.

'For safety, I'd like you all here in the observation lounge, with your seat belts properly secured, during rendezvous and touchdown. You'll get the best view from here anyway, and the whole operation won't take more than an hour. We'll only be using very small thrust corrections, but they may come from any angle and could cause minor sensory disturbances.'

What the Captain meant, of course, was spacesickness - but that word, by general agreement, was taboo aboard Universe. It was noticeable, however, that many hands strayed into the compartments beneath the seats, as if checking that the notorious plastic bags would be available if urgently required.

The image on the viewscreen expanded, as the magnification was increased. For a moment it seemed to Floyd that he was in an aeroplane, descending through light clouds, rather than in a spacecraft approaching the most famous of all comets. The nucleus was growing larger and clearer; it was no longer a black dot, but an irregular ellipse - now a small, pockmarked island lost in the cosmic ocean - then, suddenly, a world in its own right.

There was still no sense of scale. Although Floyd knew that the whole panorama spread before him was less than ten kilometres across, he could easily have imagined that he was looking at a body as large as the Moon. But the Moon was not hazy around the edges, nor did it have little jets of vapour - and two large ones - spurting from its surface.

'My God!' cried Mihailovich, 'what's that?'

He pointed to the lower edge of the nucleus, just inside the terminator. Unmistakably - impossibly -a light was flashing there on the nightside of the comet with a perfectly regular rhythm: on, off, on, off, once every two or three seconds.

Dr Willis gave his patient 'I can explain it to you in words of one syllable' cough, but Captain Smith got there first.

'I'm sorry to disappoint you, Mr Mihailovich. That's only the beacon on Sampler Probe Two - it's been sitting there for a month, waiting for us to come and pick it up.'

'What a shame; I thought there might be someone - something - there to welcome us.'

'No such luck, I'm afraid; we're very much on our own out here. That beacon is just where we intend to land - it's near Halley's south pole and is in permanent darkness at the moment. That will make it easier on our life-support systems. The temperature's up to 120 degrees on the Sunlit side - way above boiling point.'

'No wonder the comet's perking,' said the unabashed Dimitri. 'Those jets don't look very healthy to me. Are you sure it's safe to go in?'

'That's another reason we're touching down on the nightside; there's no activity there. Now, if you'll excuse me, I must get back to the bridge. This is the first chance I've ever had of landing on a new world - and I doubt if I'll get another.'

Captain Smith's audience dispersed slowly, and in unusual silence. The image on the viewscreen zoomed back to normal, and the nucleus dwindled once more to a barely visible spot. Yet even in those few minutes it seemed to have grown slightly larger, and perhaps that was no illusion. Less than four hours before encounter, the ship was still hurtling towards the comet at fifty thousand kilometres an hour.

It would make a crater more impressive than any that Halley now boasted, if something happened to the main drive at this stage of the game.

16
Touchdown

The landing was just as anticlimactic as Captain Smith had hoped. It was impossible to tell the moment when Universe made contact; a full minute elapsed before the passengers realized that touchdown was complete, and raised a belated cheer.

The ship lay at one end of a shallow valley, surrounded by hills little more than a hundred metres high. Anyone who had been expecting to see a lunar landscape would have been greatly surprised; these formations bore no resemblance at all to the smooth, gentle slopes of the Moon, sand-blasted by micrometeorite bombardment over billions of years.

There was nothing here more than a thousand years old; the Pyramids were far more ancient than this landscape. Every time around the Sun, Halley was remoulded - and diminished - by the solar fires. Even since the 1986 perihelion passage, the shape of the nucleus had been subtly changed. Melding metaphors shamelessly, Victor Willis had nevertheless put it rather well when he told his viewers: 'The "peanut" has become wasp-waisted!'

Indeed, there were indications that, after a few more revolutions round the Sun, Halley might split into two roughly equal fragments - as had Biela's comet, to the amazement of the astronomers of 1846.

The virtually non-existent gravity also contributed to the strangeness of the landscape. All around were spidery formations like the fantasies of a surrealistic artist, and improbably canted rockpiles that could not have survived more than a few minutes even on the Moon.

Although Captain Smith had chosen to land Universe in the depths of the polar night - all of five kilometres from the blistering heat of the Sun - there was ample illumination. The huge envelope of gas and dust surrounding the comet formed a glowing halo which seemed appropriate for this region; it was easy to imagine that it was an aurora, playing over the Antarctic ice. And if that was not sufficient, Lucifer provided its quota of several hundred full moons.

Although expected, the complete absence of colour was a disappointment; Universe might have been sitting in an opencast coal mine: that, in fact, was not a bad analogy, for much of the surrounding blackness was due to carbon or its compounds, intimately mixed with snow and ice.

Captain Smith, as was his due, was the first to leave the ship, pushing himself gently out from Universe's main airlock. It seemed an eternity before he reached the ground, two metres below; then he picked up a handful of the powdery surface, and examined it in his gloved hand.

Aboard the ship, everyone waited for the words that would go into the history books.

'Looks like pepper and salt,' said the Captain. 'If it were thawed out, it might grow a pretty good crop.'

* * *

The mission plan involved one complete Halley 'day' of fifty-five hours at the south pole, then - if there were no problems - a move of ten kilometres towards the very ill-defined equator, to study one of the geysers during a complete day-night cycle.

Chief Scientist Pendrill wasted no time. Almost immediately, he set off with a colleague on a two-man jet-sled towards the beacon of the waiting probe. They were back within the hour, bearing prepackaged samples of comet which they proudly consigned to the deep-freeze.

Meanwhile the other teams established a spider's web of cables along the valley, strung between poles driven into the friable crust. These served not

only to link numerous instruments to the ship, but also made movement outside much easier. One could explore this portion of Halley without the use of cumbersome External Manoeuvring Units; it was only necessary to attach a tether to a cable, and then go along it hand over hand. That was also much more fun than operating EMUs, which were virtually one-man spaceships with all the complications they involved.

The passengers watched all this with fascination, listening to the radioed conversations and trying to join in the excitement of discovery. After about twelve hours - considerably less in the case of ex-astronaut Clifford Greenburg - the pleasure of being a captive audience started to pall. Soon there was much talk about 'going outside' except from Victor Willis who was quite uncharacteristically subdued.

'I think he's scared,' said Dimitri contemptuously. He had never liked Victor, since discovering that the scientist was completely tone-deaf. Though this was wildly unfair to Victor (who had gamely allowed himself to be used as a guinea pig for studies of his curious affliction) Dimitri was fond of adding darkly 'A man that hath no music in himself, Is fit for treasons, stratagems and spoils.'

Floyd had made up his mind even before leaving Earth orbit. Maggie M was game enough to try anything and would need no encouragement. (Her slogan 'An author should never turn down the opportunity for a new experience' had impacted famously on her emotional life.)

Yva Merlin, as usual, had kept everyone in suspense, but Floyd was determined to take her on a personal tour of the comet. It was the very least he could do to maintain his reputation; everyone knew that he had been partly responsible for getting the fabulous recluse on the passenger list, and now it was a running joke that they were having an affair. Their most innocent remarks were gleefully misinterpreted by Dimitri and the ship's physician Dr Mahindran, who professed to regard them with envious awe.

After some initial annoyance - because it all too accurately recalled the emotions of his youth - Floyd had gone along with the joke. But he did not know how Yva felt about it, and had so far lacked the courage to ask her. Even now, in this compact little society where few secrets lasted more than six hours, she maintained much of her famous reserve - that aura of mystery which had fascinated audiences for three generations.

As for Victor Willis, he had just discovered one of those devastating little details that can destroy the best-laid plans of mice and spacemen.

Universe was equipped with the latest Mark XX suits, with non-fogging, non-reflective visors guaranteed to give an unparalleled view of space. And though the helmets came in several sizes, Victor Willis could not get into any of them without major surgery.

It had taken him fifteen years to perfect his trademark ('a triumph of the topiary art,' one critic had called it, perhaps admiringly).

Now only his beard stood between Victor Willis and Halley's Comet. Soon he would have to make a choice between the two.

17
The Valley of Black Snow

Captain Smith had raised surprisingly few objections to the idea of passenger EVAs. He agreed that to have come all this way, and not to set foot upon the comet, was absurd.

'There'll be no problems if you follow instructions,' he said at the inevitable briefing. 'Even if you've never worn spacesuits before - and I believe that only Commander Greenburg and Dr Floyd have done so - they're quite comfortable, and fully automatic. There's no need to bother about any controls or adjustments, after you've been checked out in the airlock.

'One absolute rule: only two of you can go EVA at one time. You'll have a personal escort, of course, linked to you by five metres of safety line - though that can be played out to twenty if necessary. In addition, you'll both be tethered to the two guide-cables we've strung the whole length of the valley. The rule of the road is the same as on Earth; keep to the right! If you want to overtake anyone, you only have to unclip your buckle - but one of you must always remain attached to the line. That way, there's no danger of drifting off into space. Any questions?'

'How long can we stay out?'

'As long as you like, Ms M'Bala. But I recommend that you return just as soon as you feel the slightest discomfort. Perhaps an hour would be best for the first outing - though it may seem like only ten minutes...'

Captain Smith had been quite correct. As Heywood Floyd looked at his time-elapsed display, it seemed incredible that forty minutes had already passed. Yet it should not have been so surprising, for the ship was already a good kilometre away.

As the senior passenger - by almost any reckoning - he had been given the privilege of making the first EVA. And he really had no choice of companion.

'EVA with Yva!' chortled Mihailovich. 'How can you possibly resist! Even if,' he added with a lewd grin, 'those damn suits won't let you try all the Extravehicular Activities you'd like,'

Yva had agreed, without any hesitation, yet also without any enthusiasm. That, Floyd thought wryly, was typical. It would not be quite true to say that he was disillusioned - at his age, he had very few illusions left - but he was disappointed. And with himself rather than Yva; she was as beyond criticism or praise as the Mona Lisa - with whom she had often been compared.

The comparison was, of course, ridiculous; La Gioconda was mysterious, but she was certainly not erotic. Yva's power had lain in her unique combination of both - with innocence thrown in for good measure. Half a century later, traces of all three ingredients were still visible, at least to the eye of faith.

What was lacking - as Floyd had been sadly forced to admit - was any real personality. When he tried to focus his mind upon her, all he could visualize were the roles she had played. He would have reluctantly agreed with the critic who had once said:

'Yva Merlin is the reflection of all men's desires; but a mirror has no character.'

And now this unique and mysterious creature was floating beside him across the face of Halley's Comet, as they and their guide moved along the twin cables that spanned the Valley of Black Snow. That was his name; he was childishly proud of it, even though it would never appear on any map. There could be no maps of a world where geography was as ephemeral as weather on Earth. He savoured the knowledge that no human eye had ever before looked upon the scene around him - or ever would again.

On Mars, or on the Moon, you could sometimes -with a slight effort of imagination, and if you ignored the alien sky - pretend that you were on Earth. This was impossible here, because the towering - often overhanging - snow sculptures showed only the slightest concession to gravity. You had to look very carefully at your surroundings to decide which way was up.

The Valley of Black Snow was unusual, because it was a fairly solid structure - a rocky reef embedded in volatile drifts of water and hydrocarbon ice. The geologists were still arguing about its origin, some maintaining that it was really part of an asteroid that had encountered the comet ages ago. Corings had revealed complex mixtures of organic compounds, rather like frozen coal-tar - though it was certain that life had never played any part in their formation.

The 'snow' carpeting of the floor of the little valley was not completely black; when Floyd raked it with the beam of his flashlight it glittered and sparkled as if embedded with a million microscopic diamonds. He wondered if there were indeed diamonds on Halley: there was certainly enough carbon here. But it was almost equally certain that the temperatures and pressures necessary to create them had never existed here.

On a sudden impulse, Floyd reached down and gathered two handfuls of the snow: he had to push with his feet against the safety line to do so, and had a comic vision of himself as a trapeze artist walking a tightrope - but upside down. The fragile crust offered virtually no resistance as he buried head and shoulders into it; then he pulled gently on his tether and emerged with his handful of Halley.

He wished that he could feel it through the insulation of his gloves, as he compacted the mass of crystalline fluff into a ball that just fitted the palm of his hand. There it lay, ebony black yet giving fugitive flashes of light as he turned it from side to side.

And suddenly, in his imagination, it became the purest white - and he was a boy again, in the winter playground of his youth, surrounded with the ghosts of his childhood. He could even hear the cries of his companions, taunting and threatening him with their own projectiles of immaculate snow...

The memory was brief, but shattering, for it brought an overwhelming sensation of sadness. Across a century of time, he could no longer remember a single one of those phantom friends who stood around him; yet some, he knew, he had once loved...

His eyes filled with tears, and his fingers clenched around the ball of alien snow. Then the vision faded; he was himself again. This was not a moment of sadness, but of triumph.

'My God!' cried Heywood Floyd, his words echoing in the tiny, reverberant universe of his spacesuit, 'I'm standing on Halley's Comet - what more do I want! If a meteor hits me now, I won't have a single complaint!'

He brought up his arms and launched the snowball towards the stars. It was so small, and so dark, that it vanished almost at once, but he kept on staring into the sky.

And then, abruptly - unexpectedly - it appeared in a sudden explosion of light, as it rose into the rays of the hidden Sun. Black as soot though it was, it reflected enough of that blinding brilliance to be easily visible against the faintly luminous sky.

Floyd watched it until it finally disappeared - perhaps by evaporation, perhaps by dwindling into the distance. It would not last long in the fierce torrent of radiation overhead; but how many men could claim to have created a comet of their own?

18
'Old Faithful'

The cautious exploration of the comet had already begun while Universe still remained in the polar shadow. First, one-man EMUs (few people now knew that stood for External Manoeuvring Unit) gently jetted over both day- and nightside, recording everything of interest. Once the preliminary surveys had been completed, groups of up to five scientists flew out in the onboard shuttle, deploying equipment and instruments at strategic spots.

The Lady Jasmine was a far cry from the primitive 'space pods' of the Discovery era, capable of operating only in a gravity-free environment. She was virtually a small spaceship, designed to ferry personnel and light cargo between the orbiting Universe and the surfaces of Mars, Moon, or the Jovian satellites. Her chief pilot, who treated her like the grande dame she was, complained with mock bitterness that flying round a miserable little comet was far beneath her dignity.

When he was quite sure that Halley - on the surface at least - held no surprises, Captain Smith lifted away from the pole. Moving less than a dozen kilometres took Universe to a different world, from a glimmering twilight that would last for months to a realm that knew the cycle of night and day. And with the dawn, the comet came slowly to life.

As the Sun crept above the jagged, absurdly close horizon, its rays would slant down into the countless small craters that pockmarked the crust. Most of them would remain inactive, their narrow throats sealed by incrustations of mineral salts. Nowhere else on Halley were such vivid displays of colour; they had misled biologists into thinking that here life was beginning, as it had on Earth, in the form of algal growths. Many had not yet abandoned that hope, though they would be reluctant to admit it.

From other craters, wisps of vapour floated up into the sky, moving in unnaturally straight trajectories because there were no winds to divert them. Usually nothing else happened for an hour or two; then, as the Sun's warmth penetrated to the frozen interior, Halley would begin to spurt - as Victor Willis had put it 'like a pod of whales'.

Though picturesque, it was not one of his more accurate metaphors. The jets from the dayside of Halley were not intermittent, but played steadily for hours at a time. And they did not curl over and fall back to the surface, but went rising on up into the sky, until they were lost in the glowing fog which they helped create.

At first, the science team treated the geysers as cautiously as if they were vulcanologists approaching Etna or Vesuvius in one of their less predictable moods. But they soon discovered that Halley's eruptions, though often fearsome in appearance, were singularly gentle and well-behaved; the water emerged about as fast as from an ordinary firehose, and was barely warm. Within seconds of escaping from its underground reservoir, it would flash into a mixture of vapour and ice crystals; Halley was enveloped in a perpetual snowstorm, falling upwards... Even at this modest speed of ejection, none of the water would ever return to its source. Each time it rounded the Sun, more of the comet's life-blood would haemorrhage into the insatiable vacuum of space.

After considerable persuasion, Captain Smith agreed to move Universe to within a hundred metres of 'Old Faithful', the largest geyser on the dayside. It was an awesome sight - a whitish-grey column of mist, growing like some giant tree from a surprisingly small orifice in a three-hundred-metre-wide crater which appeared to be one of the oldest formations on the comet. Before long, the scientists were scrambling all over the crater, collecting specimens of its (completely sterile, alas) multi-coloured minerals, and casually thrusting their thermometers and sampling tubes into the soaring water-ice-mist column itself. 'If it tosses any of you out into space,' warned the Captain, 'don't expect to be rescued in a hurry. In fact, we may just wait until you come back.'

'What does he mean by that?' a puzzled Dimitri Mihailovich had asked. As usual, Victor Willis was quick with the answer.

'Things don't always happen the way you'd expect in celestial mechanics. Anything thrown off Halley at a reasonable speed will still be moving in essentially the same orbit - it takes a huge velocity change to make a big differenc. So one revolution later, the two orbits will intersect again - and you'll be right back where you started. Seventy-six years older, of course.'

Not far from Old Faithful was another phenomenon which no-one could reasonably have anticipated. When they first observed it, the scientists could scarcely believe their eyes. Spread out across several hectares of Halley, exposed to the vacuum of space, was what appeared to be a perfectly ordinary lake, remarkable only for its extreme blackness.

Obviously, it could not be water; the only liquids which could be stable in this environment were heavy organic oils or tars. In fact, 'Lake Tuonela' turned out to be more like pitch, quite solid except for a sticky surface layer less than a millimetre thick. In this negligible gravity, it must have taken years - perhaps several trips round the warming fires of the Sun - for it to have assumed its present mirror-flatness.

Until the Captain put a stop to it, the lake became one of the principal tourist attractions on Halley's Comet. Someone (nobody claimed the dubious honour) discovered that it was possible to walk perfectly normally across it, almost as if on Earth; the surface film had just enough adhesion to hold the foot in place. Before long, most of the crew had got themselves videoed apparently walking on water...

Then Captain Smith inspected the airlock, discovered the walls liberally stained with tar, and gave the nearest thing to a display of anger that anyone had ever witnessed from him.

'It's bad enough,' he said through clenched teeth, 'having the outside of the ship coated with - soot. Halley's Comet is about the filthiest place I've ever seen...'

After that, there were no more strolls on Lake Tuonela.

19
At the End of the Tunnel

In a small, self-contained universe where everyone knows everyone else, there can be no greater shock than encountering a total stranger.

Heywood Floyd was floating gently along the corridor to the main lounge when he had this disturbing experience. He stared in amazement at the interloper, wondering how a stowaway had managed to avoid detection for so long. The other man looked back at him with a combination of embarrassment and bravado, obviously waiting for Floyd to speak first.

'Well, Victor!' he said at last. 'Sorry I didn't recognize you. So you've made the supreme sacrifice, for the cause of science - or should I say your public?'

'Yes,' Willis answered grumpily. 'I did manage to squeeze into one helmet - but the damn bristles made so many scratching noises no-one could hear a word I said.'

'When are you going out?'

'Just as soon as Cliff comes back - he's gone caving with Bill Chant.'

The first flybys of the comet, in 1986, had suggested that it was considerably less dense than water -which could only mean that it was either made of very porous material, or was riddled with cavities. Both explanations turned out to be correct.

At first, the ever-cautious Captain Smith flatly forbade any cave-exploring. He finally relented when Dr Pendrill reminded him that his chief assistant Dr Chant was an experienced speleologist - indeed, that was one of the very reasons he had been chosen for the mission.

'Cave-ins are impossible, in this low gravity,' Pendrill had told the reluctant Captain. 'So there's no danger of being trapped.'

'What about being lost?'

'Chant would regard that suggestion as a professional insult. He's been twenty kilometres inside Mammoth Cave. Anyway, he'll play out a guideline.'

'Communications?'

'The line's got fibre optics in it. And his suit radio will probably work most of the way.'

'Umm. Where does he want to go in?'

'The best place is that extinct geyser at the base of Etna Junior. It's been dead for at least a thousand years.'

'So I suppose it should keep quiet for another couple of days. Very well - does anyone else want to go?'

'Cliff Greenburg has volunteered - he's done a good deal of underwater cave-exploring, in the Bahamas.'

'I tried it once - that was enough. Tell Cliff he's much too valuable. He can go in as far as he can still see the entrance - and no further. And if he loses contact with Chant, he's not to go after him, without my authority.'

Which, the Captain added to himself, I would be very reluctant to give...

Dr Chant knew all the old jokes about speleologists wanting to return to the womb, and was quite sure he could refute them.

'That must be a damn noisy place, with all its thumpings and bumpings and gurglings,' he argued. 'I love caves because they're so peaceful and timeless. You know that nothing has changed for a hundred thousand years, except that the stalactites have grown a bit thicker.'

But now, as he drifted deeper into Halley, playing out the thin, but virtually unbreakable thread that linked him to Clifford Greenburg, he realized that this was no longer true. As yet, he had no scientific proof, but his geologist's instincts told him that this subterranean world had been born only yesterday, on the time-scale of the Universe. It was younger than some of the cities of man.

The tunnel through which he was gliding in long, shallow leaps was about four metres in diameter, and his virtual weightlessness brought back vivid memories of cave-diving on Earth. The low gravity contributed to the illusion; it was exactly as if he was carrying slightly too much weight, and so kept drifting gently downwards. Only the absence of all resistance reminded him that he was moving through vacuum, not water.

'You're just getting out of sight,' said Greenburg, fifty metres in from the entrance. 'Radio link still fine. What's the scenery like?'

'Very hard to say - I can't identify any formations, so I don't have the vocabulary to describe them. It's not any kind of rock - it crumbles when I touch it - I feel as if I'm exploring a giant Gruyère cheese.'

'You mean it's organic?'

'Yes - nothing to do with life, of course - but perfect raw material for it. All sorts of hydrocarbons - the chemists will have fun with these samples. Can you still see me?'

'Only the glow of your light, and that's fading fast.'

'Ah - here's some genuine rock - doesn't look as if it belongs here - probably an intrusion - ah - I've struck gold!'

'You're joking!'

'It fooled a lot of people in the old West - iron pyrites. Common on the outer satellites, of course, but don't ask me what it's doing here...'

'Visual contact lost. You're two hundred metres in.'

'I'm passing through a distinct layer - looks like meteoric debris - something exciting must have happened back then - I hope we can date it - wow!'

'Don't do that sort of thing to me!'

'Sorry - quite took my breath away - there's a big chamber ahead - last thing I expected - let me swing the beam around...

'Almost spherical - thirty, forty metres across. And - I don't believe it - Halley is full of surprises - stalactites, stalagmites.'

'What's so surprising about that?'

'No free water, no limestone here, of course - and such low gravity. Looks like some kind of wax. Just a minute while I get good video coverage... fantastic shapes... sort of thing a dripping candle makes... that's odd...'

'Now what?'

Dr Chant's voice had shown a sudden alteration in tone, which Greenburg had instantly detected.

'Some of the columns have been broken. They're lying on the floor. It's almost as if...'

'Go on!'

'... as if something has - blundered - into them.'

'That's crazy. Could an earthquake have snapped them?'

'No earthquakes here - only microseisms from the geysers. Perhaps there was a big blow-out at some time. Anyway, it was centuries ago. There's a film of this wax stuff over the fallen columns - several millimetres thick.'

Dr Chant was slowly recovering his composure. He was not a highly imaginative man - spelunking eliminates such men rather quickly - but the very feel of the place had triggered some disturbing memory. And those fallen columns looked altogether too much like the bars of a cage, broken by some monster in an attempt to escape.

Of course, that was perfectly absurd - but Dr Chant had learned never to ignore any premonition, any danger signal, until he had traced it to its origin. That caution had saved his life more than once; he would not go beyond this chamber until he had identified the source of his fear. And he was honest enough to admit that 'fear' was the correct word.

'Bill - are you all right? What's happening?'

'Still filming. Some of these shapes remind me of Indian temple sculpture. Almost erotic.'

He was deliberately turning his mind away from the direct confrontation of his fears, hoping thereby to sneak up on them unawares, by a kind of averted mental vision. Meanwhile the purely mechanical acts of recording and collecting samples occupied most of his attention.

There was nothing wrong, he reminded himself, with healthy fear; only when it escalated into panic did it become a killer. He had known panic twice in his life (once on a mountainside, once underwater) and still shuddered at the memory of its clammy touch. Yet - thankfully - he was far from it now, and for a reason which, though he did not understand it, he found curiously reassuring. There was an element of comedy in the situation.

And presently he started to laugh - not with hysteria, but with relief.

'Did you ever see those old Star Wars movies?' he asked Greenburg.

'Of course - half a dozen times.'

'Well, I know what's been bothering me. There was a sequence when Luke's spaceship dives into an asteroid - and runs into a gigantic snake-creature that lurks inside its caverns.'

'Not Luke's ship - Hans Solo's Millennium Falcon. And I always wondered how that poor beast managed to eke out a living. It must have grown very hungry, waiting for the occasional titbit from space. And Princess Leia wouldn't have been more than an hors-d'oeuvre, anyway.'

'Which I certainly don't intend to provide,' said Dr Chant, now completely at ease. 'Even if there is life here - which would be marvellous - the food chain would be very short. So I'd be surprised to find anything bigger than a mouse. Or, more likely, a mushroom... Now let's see - where do we go from here... There are two exits on the other side of the chamber... the one on the right is bigger... I'll take that...'

'How much more line have you got?'

'Oh, a good half-kilometre. Here we go... I'm in the middle of the chamber... damn, bounced off the wall... now I've got a hand-hold... going in head-first... smooth walls, real rock for a change... that's a pity..

'What's the problem?'

'Can't go any further. More stalactites... too close together for me to get through... and too thick to break without explosives. And that would be a shame... the colours are beautiful... first real greens and blues I've seen on Halley. Just a minute while I get them on video...

Dr Chant braced himself against the wall of the narrow tunnel, and aimed the camera. With his gloved fingers be reached for the HI-INTENSITY switch, but missed it and cut off the main lights completely.

'Lousy design,' he muttered. 'Third time I've done that.'

He did not immediately correct his mistake, because he had always enjoyed that silence and total darkness which can be experienced only in the deepest caves. The gentle background noises of his life-support equipment robbed him of the silence, but at least...

What was that? From beyond the portcullis of stalactites blocking further progress he could see a faint glow, like the first light of dawn. As his eyes grew adapted to the darkness, it appeared to grow brighter, and he could detect a hint of green. Now he could even see the outlines of the barrier ahead.

'What's happening?' said Greenburg anxiously.

'Nothing - just observing.'

And thinking, he might have added. There were four possible explanations.

Sunlight could be filtering down through some natural light duct - ice, crystal, whatever. But at this depth? Unlikely.

Radioactivity? He hadn't bothered to bring a counter; there were virtually no heavy elements here. But it would be worth coming back to check.

Some phosphorescent mineral - that was the one he'd put his money on. But there was a fourth possibility - the most unlikely, and most exciting, of all.

Dr Chant had never forgotten a moonless - and Luciferless - night on the shores of the Indian Ocean, when he had been walking beneath brilliant stars along a sandy beach. The sea was very calm, but from time to time a languid wave would collapse at his feet - and detonate in an explosion of light.

He had walked out into the shallows (he could still remember the feel of the water round his ankles, like a warm bath) and with every step he took there had been another burst of light. He could even trigger it by clapping his hands close to the surface.

Could similar bioluminescent organisms have evolved, here in the heart of Halley's Comet? He would love to think so. It seemed a pity to vandalize something so exquisite as this natural work of art - with the glow behind it, the barrier now reminded him of an altar screen he had once seen in some cathedral - but he would have to go back and get some explosives. Meanwhile, there was the other corridor...

'I can't get any further along this route,' he told Greenburg, 'so I'll try the other. Coming back to the junction - setting the reel on rewind.' He did not

mention the mysterious glow, which had vanished as soon as he switched on his lights again.

Greenburg did not reply immediately, which was unusual; probably he was talking to the ship. Chant did not worry; he would repeat his message as soon as he had got under way again.

He did not bother, because there was a brief acknowledgement from Greenburg.

'Fine, Cliff - thought I'd lost you for a minute. Back at the chamber - now going into the other tunnel - hope there's nothing blocking that.'

This time, Greenburg replied at once.

'Sorry, Bill. Come back to the ship. There's an emergency - no, not here - everything's fine with Universe. But we may have to return to Earth at once.'

It was only a few weeks before Dr Chant discovered a very plausible explanation for the broken columns. As the comet blasted its substance away into space at each perihelion passage, its mass distribution continually altered. And so, every few thousand years, its spin became unstable, and it would change the direction of its axis - quite violently, like a top that is about to fall over as it loses energy. When that occurred, the resulting cometquake could reach a respectable five on the Richter scale.

But he never solved the mystery of the luminous glow. Though the problem was swiftly overshadowed by the drama that was now unfolding, the sense of a missed opportunity would continue to haunt him for the rest of his life.

Though he was occasionally tempted, he never mentioned it to any of his colleagues. But he did leave a sealed note for the next expedition, to be opened in 2133.

20
Recall

'Have you seen Victor?' said Mihailovich gleefully, as Floyd hurried to answer the Captain's summons. 'He's a broken man.'

'He'll grow it back on the way home,' snapped Floyd, who had no time for such trivialities at the moment. 'I'm trying to find out what's happened.'

Captain Smith was still sitting, almost stunned, in his cabin when he arrived. If this was an emergency affecting his own ship, he would have been a tornado of controlled energy, issuing orders right and left. But there was nothing he could do about this situation, except await the next message from Earth.

Captain Laplace was an old friend; how could he have got into such a mess? There was no conceivable accident, error of navigation, or failure of equipment that could possibly account for his predicament. Nor, as far as Smith could see,

was there any way in which Universe could help him get out of it. Operations Centre was just running round and round in circles; this looked like one of those emergencies, all too common in space, where nothing could be done except transmit condolences and record last messages. But he gave no hint of his doubts and reservations when he reported the news to Floyd.

'There's been an accident,' he said. 'We've received orders to return to Earth immediately, to be fitted out for a rescue mission.'

'What kind of accident?'

'It's our sister ship, Galaxy. She was doing a survey of the Jovian satellites. And she's made a crash landing.'

He saw the look of amazed incredulity on Floyd's face.

'Yes, I know that's impossible. But you've not heard anything yet. She's stranded - on Europa.'

'Europa!'

'I'm afraid so. She's damaged, but apparently there's no loss of life. We're still awaiting details.'

'When did it happen?'

'Twelve hours ago. There was a delay before she could report to Ganymede.'

'But what can we do? We're on the other side of the Solar System. Getting back to lunar orbit to refuel, then taking the fastest orbit to Jupiter - it would be - oh, at least a couple of months!' (And back in Leonov's day, Floyd added to himself, it would have been a couple of years...)

'I know; but there's no other ship that could do anything.' -

'What about Ganymede's own inter-satellite ferries?'

'They're only designed for orbital operations.'

'They've landed on Callisto.'

'Much lower energy mission. Oh, they could just manage Europa, but with negligible payload. It's being looked into, of course.'

Floyd scarcely heard the Captain; he was still trying to assimilate this astonishing news. For the first time in half a century - and only for the second time in all history! - a ship had landed on the forbidden moon. And that prompted an ominous thought.

'Do you suppose,' he asked, 'that - whoever - whatever - is on Europa could be responsible?'

'I was wondering about that,' said the Captain glumly. 'But we've been snooping around the place for years, without anything happening.'

'Even more to the point - what might happen to us if we attempted a rescue?'

'That's the first thing that occurred to me. But all this is speculation - we'll have to wait until we have more facts. Meanwhile - this is really why I called you - I've just received Galaxy's crew manifest, and I was wondering...'

Hesitantly, he pushed the print-out across his desk. But even before Heywood Floyd scanned the list, he somehow knew what he would find.

'My grandson,' he said bleakly.

And, he added to himself, the only person who can carry my name beyond the grave.

III
EUROPAN ROULETTE

21
The Politics of Exile

Despite all the gloomier forecasts, the South African Revolution had been comparatively bloodless - as such things go. Television, which had been blamed for many evils, deserved some credit for this. A precedent had been set a generation earlier in the Philippines; when they know that the world is watching, the great majority of men and women tend to behave in a responsible manner. Though there have been shameful exceptions, few massacres occur on camera.

Most of the Afrikaners, when they recognized the inevitable, had left the country long before the takeover of power. And - as the new administration bitterly complained - they had not gone empty-handed. Billions of rands had been transferred to Swiss and Dutch banks; towards the end, there had been mysterious flights almost every hour out of Cape Town and Jo'burg to Zurich and Amsterdam. It was said that by Freedom Day one would not find one troy ounce of gold or a carat of diamond in the late Republic of South Africa - and the mine workings had been effectively sabotaged. One prominent refugee boasted, from his luxury apartment in The Hague, 'It will be five years before the Kaffirs can get Kimberley working again - if they ever do.' To his great surprise, De Beers was back in business, under new name and management, in less than five weeks, and diamonds were now the single most important element in the new nation's economy.

Within a generation, the younger refugees had been absorbed - despite desperate rearguard actions by their conservative elders - in the deracinated culture of the twenty-first century. They recalled, with pride but without boastfulness, the courage and determination of their ancestors, and distanced themselves from their stupidities. Virtually none of them spoke Afrikaans, even in their own homes.

Yet, precisely as in the case of the Russian Revolution a century earlier, there were many who dreamed of putting back the clock - or, at least, of sabotaging the efforts of those who had usurped their power and privilege. Usually they channelled their frustration and bitterness into propaganda, demonstrations, boycotts, petitions to the World Council - and, rarely, works of

art. Wilhelm Smuts' The Voortrekkers was conceded to be a masterpiece of (ironically) English literature, even by those who bitterly disagreed with the author.

But there were also groups who believed that political action was useless, and that only violence would restore the longed-for status quo. Although there could not have been many who really imagined that they could rewrite the pages of history, there were not a few who, if victory was impossible, would gladly settle for revenge.

Between the two extremes of the totally assimilated and the completely intransigent, there was an entire spectrum of political - and apolitical - parties. Der Bund was not the largest, but it was the most powerful, and certainly the richest, since it controlled much of the lost Republic's smuggled wealth, through a network of corporations and holding companies. Most of these were now perfectly legal, and indeed completely respectable.

There was half a billion of Bund money in Tsung Aerospace, duly listed in the annual balance sheet. In 2059, Sir Lawrence was happy to receive another half-billion, which enabled him to accelerate the commissioning of his little fleet.

But not even his excellent intelligence traced any connection between the Bund and Tsung Aerospace's latest charter mission, In any event, Halley was then approaching Mars, and Sir Lawrence was so busy getting Universe ready to leave on schedule that he paid little attention to the routine operations of her sister ships.

Though Lloyd's of London did raise some queries about Galaxy's proposed routing, these objections were quickly dealt with. The Bund had people in key positions everywhere; which was unfortunate for the insurance brokers, but very good luck for the space lawyers.

22
Hazardous Cargo

It is not easy to run a shipping line between destinations which not only change their positions by millions of kilometres every few days, but also swing through a velocity range of tens of kilometres a second. Anything like a regular schedule is out of the question; there are times when one must forget the whole idea and stay in port - or at least in orbit - waiting for the Solar System to rearrange itself for the greater convenience of mankind.

Fortunately, these periods are known years in advance, so it is possible to make the best use of them for overhauls, retrofits, and planet leave for the crew. And occasionally, by good luck and aggressive salesmanship, one can arrange some local chartering, even if only the equivalent of the old-time 'Once around the Bay' boat-ride.

Captain Eric Laplace was delighted that the three-month stayover off Ganymede would not be a complete loss. An anonymous and unexpected grant to the Planetary Science Foundation would finance a reconnaissance of the Jovian (even now, no-one ever called it Luciferian) satellite system, paying particular

attention to a dozen of the neglected smaller moons. Some of these had never even been properly surveyed, much less visited.

As soon as he heard of the mission, Rolf van der Berg called the Tsung shipping agent and made some discreet enquiries.

'Yes, first we'll head in towards Io - then do a flyby of Europa -'

'Only a flyby? How close?'

'Just a moment - odd, the flight plan doesn't give details. But of course she won't go inside the Interdiction Zone.'

'Which was down to ten thousand kilometres at the last ruling... fifteen years ago. Anyway, I'd like to volunteer as Mission Planetologist. I'll send across my qualifications -'

'No need to do so, Dr van der Berg. They've already asked for you.'

It is always easy to be wise after the event, and when he cast his mind back (he had plenty of time for it later) Captain Laplace recalled a number of curious aspects of the charter. Two crew members were taken suddenly sick, and were replaced at short notice; he was so glad to have substitutes that he did not check their papers as closely as he might have done. (And even if he had, he would have discovered that they were perfectly in order.)

Then there was the trouble with the cargo. As captain, he was entitled to inspect anything that went aboard the ship. Of course, it was impossible to do this for every item, but he never hesitated to investigate if he had good reason. Space crews were, on the whole, a highly responsible body of men; but long missions could be boring, and there were tedium-relieving chemicals which - though perfectly legal on Earth - should be discouraged off it.

When Second Officer Chris Floyd reported his suspicions, the Captain assumed that the ship's chromatographic 'sniffer' had detected another cache of the high-grade opium which his largely Chinese crew occasionally patronized. This time, however, the matter was serious - very serious.

'Cargo Hold Three, Item 2/456, Captain. The manifest says "Scientific apparatus". It contains explosives.'

'What!'

'Definitely, Sir. Here's the electrogram.'

'I'll take your word for it, Mr Floyd. Have you inspected the item?'

'No, Sir. It's in a sealed crew case, half a metre by one metre by five metres, approximately. One of the largest packages the science team brought aboard. It's labelled FRAGILE - HANDLE WITH CARE. But so is everything, of course.'

Captain Laplace drummed his fingers thoughtfully on the grained plastic 'wood' of his desk. (He hated the pattern, and intended to get rid of it on the next refit.) Even that slight action started him rising out of his seat, and he

automatically anchored himself by wrapping his foot around the pillar of the chair.

Though he did not for a moment doubt Floyd's report - his new Second Officer was very competent, and the Captain was pleased that he had never brought up the subject of his famous grandfather -there could be an innocent explanation. The sniffer might have been misled by other chemicals with nervous molecular bondings.

They could go down into the hold and force open the package. No - that might be dangerous, and could cause legal problems as well. Best to go straight to the top; he'd have to do that anyway, sooner or later.

'Please bring Dr Anderson here - and don't mention this to anyone else,'

'Very good, Sir.' Chris Floyd gave a respectful but quite unnecessary salute, and left the room in a smooth, effortless glide.

The leader of the science team was not accustomed to zero gravity, and his entrance was quite clumsy. His obvious genuine indignation did not help, and he had to grab the Captain's desk several times in an undignified manner.

'Explosives! Of course not! Let me see the manifest... 2/456...'

Dr Anderson pecked out the reference on his portable keyboard, and slowly read off: "Mark V penetrometers, Quantity three." Of course - no problem.'

'And just what,' said the Captain, 'is a penetrometer?' Despite his concern, he had difficulty in suppressing a smile; it sounded a little obscene.

'Standard planetary sampling device. You drop it, and with any luck it will give you a core up to ten metres long - even in hard rock. Then it sends back a complete chemical analysis. The only safe way to study places like dayside Mercury - or Io, where we'll drop the first one.'

'Dr Anderson,' said the Captain, with great selfrestraint, 'you may be an excellent geologist, but you don't know much about celestial mechanics. You can't just drop things from orbit -'

The charge of ignorance was clearly unfounded, as the scientist's reaction proved.

'The idiots!' he said. 'Of course, you should have been notified.'

'Exactly. Solid fuel rockets are classified as "Hazardous Cargo". I want clearance from the underwriters, and your personal assurance that the safety systems are adequate; otherwise, they go overboard. Now, any other little surprises? Were you planning seismic surveys? I believe those usually involve explosives...'

A few hours later, the somewhat chastened scientist admitted that he had also found two bottles of elemental fluorine, used to power the lasers which could zap passing celestial bodies at thousand-kilometre ranges for spectrographic sampling. As pure fluorine was about the most vicious substance known to man, it was high on the list of prohibited materials - but, like the rockets which drove the penetrometers down to their targets, it was essential for the mission.

When he was quite satisfied that all the necessary precautions had been taken, Captain Laplace accepted the scientist's apologies, and his assurance that the oversight was entirely due to the haste with which the expedition had been organized.

He felt sure that Dr Anderson was telling the truth, but already he felt that there was something odd about the mission.

Just how odd he could never have imagined.

23
Inferno

Before the detonation of Jupiter, Io had been second only to Venus as the best approximation to Hell in the Solar System. Now that Lucifer had raised its surface temperature another couple of hundred degrees, even Venus could no longer compete.

The sulphur volcanoes and geysers had multiplied their activity, now reshaping the features of the tormented satellite in years rather than decades. The planetologists had given up any attempt at mapmaking, and contented themselves with taking orbital photographs every few days. From these, they had constructed awe-inspiring time-lapse movies of inferno in action.

Lloyd's of London had charged a stiff premium for this leg of the mission, but Io posed no real danger to a ship doing a flyby at a minimum range of ten thousand kilometres - and over the relatively quiescent nightside at that.

As he watched the approaching yellow and orange globe - the most improbably garish object in the entire Solar System - Second Officer Chris Floyd could not help recalling the time, now half a century ago, when his grandfather had come this way. Here, Leonov had made its rendezvous with the abandoned Discovery, and here Dr Chandra had reawakened the dormant computer Hal. Then both ships had flown on to survey the enormous black monolith hovering at L1, the Inner Lagrange Point between Io and Jupiter.

Now the monolith was gone - and so was Jupiter. The minisun that had risen like a phoenix from the implosion of the giant planet had turned its satellites into what was virtually another Solar System, though only on Ganymede and Europa were there regions with Earthlike temperatures. How long that would continue to be the case, no-one knew. Estimates of Lucifer's life-span ranged from a thousand to a million years.

Galaxy's science team looked wistfully at the L1 point, but it was now far too dangerous to approach. There had always been a river of electrical energy - the Io 'flux tube' - flowing between Jupiter and its inner satellite, and the creation of Lucifer had increased its strength several hundredfold. Sometimes the river of power could even be seen by the naked eye, glowing yellow with the characteristic light of ionized sodium. Some engineers on Ganymede had talked hopefully about tapping the gigawatts going to waste next door, but no-one could think of a plausible way of doing so.

The first penetrometer was launched, with vulgar comments from the crew, and two hours later drove like a hypodermic needle into the festering satellite. It continued to operate for almost five seconds - ten times its designed lifetime - broadcasting thousands of chemical, physical and rheological measurements, before Io demolished it.

The scientists were ecstatic; van der Berg was merely pleased. He had expected the probe to work; Io was an absurdly easy target. But if he was right about Europa, the second penetrometer would surely fail.

Yet that would prove nothing; it might fail for a dozen good reasons. And when it did, there would be no alternative but a landing.

Which, of course, was totally prohibited - not only by the laws of man.

24
Shaka the Great

ASTROPOL - which, despite its grandiose title, had disappointingly little business off Earth - would not admit that SHAKA really existed. The USSA took exactly the same position, and its diplomats became embarrassed or indignant when anyone was tactless enough to mention the name.

But Newton's Third Law applies in politics, as in everything else. The Bund had its extremists -though it tried, sometimes not very hard, to disown them - continually plotting against the USSA. Usually they confined themselves to attempts at commercial sabotage, but there were occasional explosions, disappearances and even assassinations.

Needless to say, the South Africans did not take this lightly. They reacted by establishing their own official counter-intelligence services, which also had a rather free-wheeling range of operations - and likewise claimed to know nothing about SHAKA. Perhaps they were employing the useful CIA invention of 'plausible deniability'. It is even possible that they were telling the truth.

According to one theory, SHAKA started as a codeword, and then - rather like Prokofiev's 'Lieutenant Kije' - had acquired a life of its own, because it was useful to various clandestine bureaucracies. This would certainly account for the fact that none of its members had ever defected, or even been arrested.

But there was another, somewhat far-fetched explanation for this, according to those who believed that SHAKA really did exist. All its agents had been psychologically conditioned to self-destruct before there was any possibility of interrogation.

Whatever the truth, no-one could seriously imagine that, more than two centuries after his death, the legend of the great Zulu tyrant would cast its shadow across worlds he never knew.

25
The Shrouded World

During the decade after the ignition of Jupiter, and the spreading of the Great Thaw across its satellite system, Europa had been left strictly alone. Then the Chinese had made a swift flyby, probing the clouds with radar in an attempt to locate the wreck of the Tsien. They had been unsuccessful, but their maps of dayside were the first to show the new continents now emerging as the ice-cover melted.

They had also discovered a perfectly straight two-kilometre-long feature which looked so artificial that it was christened the Great Wall. Because of its shape and size it was assumed to be the Monolith -or a monolith, since millions had been replicated in the hours before the creation of Lucifer.

However, there had been no reaction, or any hint of an intelligent signal, from below the steadily thickening clouds. So a few years later, survey satellites were placed in permanent orbit, and high-altitude balloons were dropped into the atmosphere to study its wind patterns. Terrestrial meteorologists found these of absorbing interest, because Europa - with a central ocean, and a sun that never set - presented a beautifully simplified model for their text-books.

So had begun the game of 'Europan Roulette', as the administrators were fond of calling it whenever the scientists proposed getting closer to the satellite.

After fifty uneventful years, it had become somewhat boring. Captain Laplace hoped it would remain that way, and had required considerable reassurance from Dr Anderson.

'Personally,' he had told the scientist, 'I would regard it as a slightly unfriendly act, to have a ton of armour-piercing hardware dropped on me at a thousand kilometres an hour. I'm quite surprised the World Council gave you permission.'

Dr Anderson was also a little surprised, though he might not have been had he known that the project was the last item on a long agenda of a Science SubCommittee late on a Friday afternoon. Of such trifles history is made.

'I agree, Captain. But we are operating under very strict limitations, and there's no possibility of interfering with the - ah - Europans, whoever they are. We're aiming at a target five kilometres above sea level.'

'So I understand. What's so interesting about Mount Zeus?'

'It's a total mystery. It wasn't even there, only a few years ago. So you can understand why it drives the geologists crazy.'

'And your gadget will analyse it when it goes in.'

'Exactly. And - I really shouldn't be telling you this - but I've been asked to keep the results confidential, and to send them back to Earth encrypted. Obviously, someone's on the track of a major discovery, and wants to make quite sure they're not beaten to a publication. Would you believe that scientists could be so petty?'

Captain Laplace could well believe it, but did not want to disillusion his passenger. Dr Anderson seemed touchingly naïve; whatever was going on - and the Captain was now quite certain there was much more to this mission than met the eye - Anderson knew nothing about it.

'I can only hope, Doctor, that the Europans don't go in for mountain climbing. I'd hate to interrupt any attempt to put a flag on their local Everest.'

There was a feeling of unusual excitement aboard Galaxy when the penetrometer was launched - and even the inevitable jokes were muted. During the two hours of the probe's long fall towards Europa, virtually every member of the crew found some perfectly legitimate excuse to visit the bridge and watch the guidance operation. Fifteen minutes before impact, Captain Laplace declared it out of bounds to all visitors, except the ship's new steward Rosie; without her endless supply of squeezebulbs full of excellent coffee, the operation could not have continued.

Everything went perfectly. Soon after atmospheric entry, the air-brakes were deployed, slowing the penetrometer to an acceptable impact velocity. The radar image of the target - featureless, with no indication of scale - grew steadily on the screen. At minus one second, all the recorders switched automatically to high speed...

But there was nothing to record. 'Now I know,' said Dr Anderson sadly, 'just how they felt at the Jet Propulsion Lab, when those first Rangers crashed into the Moon - with their cameras blind.'

26
Night Watch

Only time is universal; night and day are merely quaint local customs, found on those planets which tidal forces have not yet robbed of their rotation. But however far they travel from their native world, human beings can never escape the diurnal rhythm, set ages ago by its cycle of light and darkness.

So at 01.05, Universal Time, Second Officer Chang was alone on the bridge, while the ship was sleeping around him. There was no real need for him to be awake either, since Galaxy's electronic senses would detect any malfunction far sooner than he could possibly do. But a century of cybernetics had proved that human beings were still slightly better than machines at dealing with the unexpected; and sooner or later, the unexpected always happened.

'Where's my coffee?' thought Chang grumpily. 'It's not like Rosie to be late.' He wondered if the steward had been affected by the same malaise that had overtaken both scientists and space crew, after the disasters of the last twenty-four hours.

Following the failure of the first penetrometer, there had been a hasty conference to decide the next step. One unit was left; it had been intended for Callisto, but it could be used just as easily here.

'And anyway,' Dr Anderson had argued, 'we've landed on Callisto - there's nothing there except assorted varieties of cracked ice.'

There had been no disagreement. After a twelve-hour delay for modification and testing, Pen No. 3 was launched into the Europan cloudscape, following the invisible track of its precursor.

This time, the ship's recorders did get some data - for about half a millisecond. The accelerometer on the probe, which was calibrated to operate up to 20,000 gee, gave one brief pulse before going off-scale. Everything must have been destroyed in very much less than the twinkling of an eye.

After a second, and even gloomier, post-mortem, it was decided to report to Earth, and wait in high orbit round Europa for any further instructions, before proceeding to Callisto and the outer moons,

'Sorry to be late, Sir,' said Rose McCullen (one would never guess from her name that she was slightly darker than the coffee she was carrying) 'but I must have set the alarm wrong.'

'Lucky for us,' chuckled the Officer of the Watch, 'that you're not running the ship.'

'I don't understand how anyone could run it,' answered Rose. 'It all looks so complicated.'

'Oh, it's not as bad as it looks,' said Chang. 'And don't they give you basic space theory in your training course?'

'Er - yes. But I never understood much of it. Orbits and all that nonsense.'

Second Officer Chang was bored, and felt it would be a kindness to enlighten his audience. And although Rose was not exactly his type, she was undoubtedly attractive; a little effort now might be a worthwhile investment. It never occurred to him that, having performed her duty, Rose might like to go back to sleep.

Twenty minutes later, Second Officer Chang waved at the navigation console and concluded expansively: 'So you see, it's really almost automatic. You only have to punch in a few numbers and the ship takes care of the rest.'

Rose seemed to be getting tired; she kept looking at her watch.

'I'm sorry,' said the suddenly contrite Chang. 'I shouldn't have kept you up.'

'Oh no - it's extremely interesting. Please go on.'

'Definitely not. Maybe some other time. Goodnight, Rosie - and thanks for the coffee.'

'Goodnight, Sir.'

Steward Third Class Rose McCullen glided (not too skilfully) towards the still open door. Chang did not bother to look back when he heard it close.

It was thus a considerable shock when, a few seconds later, he was addressed by a completely unfamiliar female voice.

'Mr Chang - don't bother to touch the alarm button - it's disconnected. Here are the landing coordinates. Take the ship down.'

Slowly, wondering if he had somehow dozed off and was having a nightmare, Chang rotated his chair.

The person who had been Rose McCullen was floating beside the oval hatchway, steadying herself by holding on to the locking lever of the door. Everything about her seemed to have changed; in a moment of time, their roles had been reversed. The shy steward - who had never before looked at him directly - was now regarding Chang with a cold, merciless stare that made him feel like a rabbit hypnotized by a snake. The small but deadly-looking gun nestling in her free hand seemed an unnecessary adornment; Chang had not the slightest doubt that she could very efficiently kill him without it.

Nevertheless, both his self-respect and his professional honour demanded that he should not surrender without some sort of a struggle. At the very least, he might be able to gain time.

'Rose,' he said - and now his lips had difficulty in forming a name which had become suddenly inappropriate - 'this is perfectly ridiculous. What I told you just now - it's simply not true. I couldn't possibly land the ship by myself. It would take hours to compute the correct orbit, and I'd need someone to help me. A co-pilot, at least.'

The gun did not waver.

'I'm not a fool, Mr Chang. This ship isn't energy-limited, like the old chemical rockets. The escape velocity of Europa is only three kilometres a second. Part of your training is an emergency landing with the main computer down. Now you can put it into practice: the window for an optimum touchdown at the coordinates I will give you opens in five minutes.'

'That type of abort,' said Chang, now beginning to sweat profusely, 'has an estimated twenty-five per cent failure rate' - the true figure was ten per cent, but in the circumstances he felt that a little exaggeration was justified - 'and it's years since I checked out on it.'

'In that case,' answered Rose McCullen, 'I'll have to eliminate you and ask the Captain to send me someone more qualified. Annoying, because we'll miss this window and have to wait a couple of hours for the next one. Four minutes left.'

Second Officer Chang knew when he was beaten; but at least he had tried.

'Let me have those coordinates,' he said.

27
Rosie

Captain Laplace woke instantly at the first gentle tapping, like a distant woodpecker, of the attitude control jets. For a moment he wondered if he was dreaming: no, the ship was definitely turning in space.

Perhaps it was getting too hot on one side and the thermal control system was making some minor adjustments. That did happen occasionally, and was a black mark for the officer on duty, who should have noticed that the temperature envelope was being approached.

He reached for the intercom button to call - who was it? - Mr Chang on the bridge. His hand never completed the movement.

After days of weightlessness, even a tenth of a gravity is a shock. To the Captain it seemed like minutes, though it must have been only a few seconds, before he could unbuckle his restraining harness and struggle out of his bunk. This time, he found the button and jabbed it viciously. There was no reply.

He tried to ignore the thuds and bumps of inadequately secured objects that had been taken unawares by the onset of gravity. Things seemed to go on falling for a long time, but presently the only abnormal sound was the muffled, far-off scream of the drive at full blast.

He tore open the curtain of the cabin's little window, and looked out at the stars. He knew roughly where the ship's axis should have been pointing; even if he could only judge it to within thirty or forty degrees, that would allow him to distinguish between the two possible alternatives.

Galaxy could be vectored either to gain, or to lose, orbital velocity. It was losing it - and therefore preparing to fall towards Europa.

There was an insistent banging on the door, and the Captain realized that little more than a minute could really have passed. Second Officer Floyd and two other crew members were crowded in the narrow passageway.

'The bridge is locked, Sir,' Floyd reported breathlessly. 'We can't get in - and Chang doesn't answer. We don't know what's happened.'

'I'm afraid I do,' Captain Laplace answered, climbing into his shorts. 'Some madman was bound to try it sooner or later. We've been hijacked, and I know where. But I'm damned if I know why.'

He glanced at his watch, and did a quick mental calculation.

'At this thrust level, we'll have deorbited within fifteen minutes - make it ten for safety. Any way we can cut the drive without endangering the ship?'

Second Officer Yu, Engineering, looked very unhappy, but volunteered a reluctant reply.

'We could pull the circuit breakers in the pump motor lines, and cut off the propellant supply.'

'Can we get at them?'

'Yes - they're on Deck Three.'

'Then let's go.'

'Er - then the independent backup system would take over. For safety, that's behind a sealed bulkhead on Deck Five - we'd have to get a cutter - no, it couldn't be done in time.'

Captain Laplace had been afraid of that. The men of genius who had designed Galaxy had tried to protect the ship from all plausible accidents. There was no way they could have safeguarded it against human malevolence.

'Any alternatives?'

'Not in the time available, I'm afraid.'

'Then let's get to the bridge and see if we can talk to Chang - and whoever is with him.'

And who could that be? he wondered. He refused to believe that it could be one of his regular crew. That left - of course, there was the answer! He could see it all. Monomaniac researcher tries to prove theory - experiments frustrated - decides that the quest for knowledge takes precedence over everything else.

It was uncomfortably like one of those cheap 'mad scientist' melodramas, but it fitted the facts perfectly. He wondered if Dr Anderson had decided that this was the only road to a Nobel Prize.

That theory was swiftly demolished when the breathless and dishevelled geologist arrived gasping:

'For God's sake, Captain - what's happening? We're under full thrust! Are we going up - or down?'

'Down,' answered Captain Laplace. 'In about ten minutes, we'll be in an orbit that will hit Europa. I can only hope that whoever's at the controls knows what he's doing.'

Now they were at the bridge, facing the closed door. Not a sound came from the far side.

Laplate rapped as loudly as he possibly could without bruising his knuckles.

'This is the Captain! Let us in!'

He felt rather foolish at giving an order which would certainly be ignored, but he hoped for at least some reaction. To his surprise, he got one.

The external speaker hissed into life, and a voice said: 'Don't attempt anything foolish, Captain. I have a gun, and Mr Chang is obeying my orders.'

'Who was that?' whispered one of the officers. 'It sounds like a woman!'

'You're right,' said the Captain grimly. That certainly cut down the alternatives, but didn't help matters in any way.

'What do you hope to do? You know you can't possibly get away with it!' he shouted, trying to sound masterful rather than plaintive.

'We're landing on Europa. And if you want to take off again, don't try to stop me.'

'Her room's completely clean,' Second Officer Chris Floyd reported thirty minutes later, when the thrust had been cut to zero and Galaxy was falling along the ellipse which would soon graze the atmosphere of Europa. They were now committed; although it would now be possible to immobilize the engines, it would be suicide to do so. They would be needed again to make a landing - although that could be merely a more protracted form of suicide.

'Rosie McCullen! Who would have believed it! Do you suppose she's on drugs?'

'No,' said Floyd. 'This has been very carefully planned. She must have a radio hidden somewhere in the ship. We should search for it.'

'You sound like a damned cop.'

'That will do, gentlemen,' said the Captain. Tempers were getting frayed, largely through sheer frustration and the total failure to establish any further contact with the barricaded bridge. He glanced at his watch.

'Less than two hours before we enter atmosphere - what there is of it. I'll be in my cabin - it's just possible they may try to call me there. Mr Yu, please stand by the bridge and report any developments at once.'

He had never felt so helpless in his life, but there were times when doing nothing was the only thing to do. As he left the officers' wardroom, he heard someone say wistfully: 'I could do with a bulb of coffee. Rosie made the best I've ever tasted.'

Yes, thought the Captain grimly, she's certainly efficient. Whatever job she tackles, she'll do it thoroughly.

28
Dialogue

There was only one man aboard Galaxy who could regard the situation as anything but a total disaster. I may be about to die, Rolf van der Berg told himself; but at least I have a chance of scientific immortality. Though that might be poor consolation, it was more than anyone else on the ship could hope for.

That Galaxy was heading for Mount Zeus he did not doubt for a moment; there was nothing else on Europa of any significance. Indeed, there was nothing remotely comparable on any planet.

So his theory - and he had to admit that it was still a theory - was no longer a secret. How could it have leaked out?

He trusted Uncle Paul implicitly, but he might have been indiscreet. More likely, someone had monitored his computers, perhaps as a matter of routine. If

so, the old scientist could well be in danger; Rolf wondered if he could - or should - get a warning to him. He knew that the communications officer was trying to contact Ganymede via one of the emergency transmitters; an automatic beacon alert had already gone out, and the news would be hitting Earth any minute now. It had been on its way now for almost an hour...

'Come in,' he said, at the quiet knock on his cabin door. 'Oh - hello, Chris. What can I do for you?'

He was surprised to see Second Officer Chris Floyd, whom he knew no better than any of his other colleagues. If they landed safely on Europa, he thought gloomily, they might get to know each other far better than they wished.

'Hello, Doctor. You're the only person who lives around here. I wondered if you could help me.'

'I'm not sure how anyone can help anyone at the moment. What's the latest from the bridge?'

'Nothing new: I've just left Yu and Gillings up there, trying to fix a mike on the door. But no-one inside seems to be talking; not surprising - Chang must have his hands full.'

'Can he get us down safely?'

'He's the best; if anyone can do it, he can. I'm more worried about getting off again.'

'God - I'd not been looking that far ahead. I assumed that was no problem.'

'It could be marginal. Remember, this ship is designed for orbital operations. We hadn't planned to put down on any major moon - though we had hoped to rendezvous with Ananke and Carme. So we could be stuck on Europa - especially if Chang has to waste propellant looking for a good landing site.'

'Do we know where he is trying to land?' Rolf asked, trying not to sound more interested than might be reasonably expected. He must have failed, because Chris looked at him sharply.

'There's no way we can tell at this stage, though we may get a better idea when he starts braking. But you know these moons; where do you think?'

'There's only one interesting place. Mount Zeus.'

'Why should anyone want to land there?'

RoIf shrugged.

'That was one of the things we'd hoped to find out. Cost us two expensive penetrometers.'

'And it looks like costing a great deal more. Haven't you any ideas?'

'You sound like a cop,' said van der Berg with a grin, not intending it in the least seriously.

'Funny - that's the second time I've been told that in the last hour.'

Instantly, there was a subtle change in the atmosphere of the cabin - almost as if the life-support system had readjusted itself.

'Oh - I was just joking - are you?'

'If I was, I wouldn't admit it, would I?'

That was no answer, thought van der Berg; but on second thoughts, perhaps it was.

He looked intently at the young officer, noticing - not for the first time - his striking resemblance to his famous grandfather. Someone had mentioned that Chris Floyd had only joined Galaxy on this mission, from another ship in the Tsung fleet - adding sarcastically that it was useful to have good connections in any business. But there had been no criticism of Floyd's ability; he was an excellent space officer. Those skills might qualify him for other part-time jobs as well; look at RosieMcCulIen - who had also, now he came to think of it, joined Galaxy just before this mission.

Rolf van der Berg felt that he had become enmeshed in some vast and tenuous web of interplanetary intrigue; as a scientist, accustomed to getting - usually - straightforward answers to the questions he put to nature, he did not enjoy the situation.

But he could hardly claim to be an innocent victim. He had tried to conceal the truth - or at least what he believed to be the truth. And now the consequences of that deceit had multiplied like the neutrons in a chain reaction; with results that might be equally disastrous.

Which side was Chris Floyd on? How many sides were there? The Bund would certainly be involved, once the secret had leaked out. But there were splinter groups within the Bund itself, and groups opposing them; it was like a hall of mirrors.

There was one point, however, on which he did feel reasonably certain. Chris Floyd, if only because of his connections, could be trusted. I'd put my money, thought van der Berg, on him being assigned to ASTROPOL for the duration of the mission - however long, or short, that might now be.

'I'd like to help you, Chris,' he said slowly. 'As you probably suspect, I do have some theories. But they may still be utter nonsense.

'In less than half an hour, we may know the truth. Until then, I prefer to say nothing.'

And this is not, he told himself, merely ingrained Boer stubbornness. If he had been mistaken, he would prefer not to die among men who knew that he was the fool who had brought them to their doom.

29
Descent

Second Officer Chang had been wrestling with the problem ever since Galaxy had been successfully - to his surprise as much as his relief - injected into transfer orbit. For the next couple of hours she was in the hands of God, or at least Sir Isaac Newton; there was nothing to do but wait until the final braking and descent manoeuvre.

He had briefly considered trying to fool Rosie by giving the ship a reverse vector at closest approach, and so taking it out into space again. It would then be back in a stable orbit, and a rescue could eventually be mounted from Ganymede. But there was a fundamental objection to this scheme: he would certainly not be alive to be rescued. Though Chang was no coward, he would prefer not to become a posthumous hero of the spaceways.

In any event, his chances of surviving the next hour seemed remote. He had been ordered to take down, single-handed, a three-thousand tonner on totally unknown territory. This was not a feat he would care to attempt even on the familiar Moon.

'How many minutes before you start braking?' asked Rosie. Perhaps it was more of an order than a question; she clearly understood the fundamentals of astronautics, and Chang abandoned his last wild fantasies of outwitting her.

'Five,' he said reluctantly. 'Can I warn the rest of the ship to stand by?'

'I'll do it. Give me the mike... THIS IS THE BRIDGE. WE START BRAKING IN FIVE MINUTES. REPEAT, FIVE MINUTES. OUT.'

To the scientists and officers assembled in the wardroom, the message was fully expected. They had had one piece of luck; the external video monitors had not been switched off. Perhaps Rose had forgotten about them; it was more likely that she had not bothered. So now, as helpless spectators - quite literally, a captive audience - they could watch their unfolding doom.

The cloudy crescent of Europa now filled the field of the rear-view camera. There was no break anywhere in the solid overcast of water vapour recondensing on its way back to nightside. That was not important, since the landing would be radar-controlled until the last moment. It would, however, prolong the agony of observers who had to rely on visible light,

No-one stared more intently at the approaching world than the man who had studied it with such frustration for almost a decade. Rolf van der Berg, seated in one of the flimsy low-gravity chairs with the restraining belt lightly fastened, barely noticed the first onset of weight as braking commenced.

In five seconds, they were up to full thrust. All the officers were doing rapid calculations on their comsets; without access to Navigation, there would be a lot of guesswork, and Captain Laplace waited for a consensus to emerge.

'Eleven minutes,' he announced presently, 'assuming he doesn't reduce thrust level - he's at max now. And assuming he's going to hover at ten kilometres - just above the overcast - and then go straight down. That could take another five minutes.'

It was unnecessary for him to add that the last second of those five minutes would be the most critical.

Europa seemed determined to keep its secrets to the very end. When Galaxy was hovering motionless, just above the cloudscape, there was still no sign of the land - or sea - beneath. Then, for a few agonizing seconds, the screens became completely blank - except for a glimpse of the now extended, and very seldom used, landing gear. The noise of its emergence a few minutes earlier had caused a brief flurry of alarm among the passengers; now they could only hope that it would perform its duty.

How thick is this damn cloud? van der Berg asked himself. Does it go all the way down -No, it was breaking, thinning out into shreds and wisps - and there was the new Europa, spread out, it seemed, only a few thousand metres below.

It was indeed new; one did not have to be a geologist to see that. Four billion years ago, perhaps, the infant Earth had looked like this, as land and sea prepared to begin their endless conflict.

Here, until fifty years ago, there had been neither land nor sea - only ice. But now the ice had melted on the Lucifer-facing hemisphere, the resulting water had boiled upwards - and been deposited in the permanent deep-freeze of nightside. The removal of billions of tons of liquid from one hemisphere to the other had thus exposed ancient seabeds that had never before known even the pale light of the far-distant Sun.

Some day, perhaps, these contorted landscapes would be softened and tamed by a spreading blanket of vegetation; now they were barren lava flows and gently steaming mud flats, interrupted occasionally by masses of up-thrust rock with strangely slanting strata. This had clearly been an area of great tectonic disturbance, which was hardly surprising if it had seen the recent birth of a mountain the size of Everest.

And there it was - looming up over the unnaturally close horizon. Rolf van der Berg felt a tightness in his chest, and a tingling of the flesh at the back of his neck. No longer through the remote impersonal senses of instruments, but with his own eyes, he was seeing the mountain of his dreams.

As he well knew, it was in the approximate shape of a tetrahedron, tilted so that one face was almost vertical. (That would be a nice challenge to climbers, even in this gravity - especially as they couldn't drive pitons into it...) The summit was hidden in the clouds, and much of the gently-sloping face turned towards them was covered with snow.

'Is that what all the fuss is about?' muttered someone in disgust. 'Looks like a perfectly ordinary mountain to me. I guess that once you've seen one -' He was 'shushed' angrily into silence.

Galaxy was now drifting slowly towards Mount Zeus, as Chang searched for a good landing place. The ship had very little lateral control, as ninety per cent of the main thrust had to be used merely to support it. There was enough propellant to hover for perhaps five minutes; after that, he might still be able to land safely - but he could never take off again.

Neil Armstrong had faced the same dilemma, almost a hundred years ago. But he had not been piloting with a gun aimed at his head.

Yet for the last few minutes, Chang had totally forgotten both gun and Rosie. Every sense was focused on the job ahead; he was virtually part of the great machine he was controlling. The only human emotion left to him was not

fear - but exhilaration. This was the job he had been trained to perform; this was the highlight of his professional career - even as it might be the finale.

And that was what it looked like becoming. The foot of the mountain was now less than a kilometre away - and he had still found no landing site. The terrain was incredibly rugged, torn with canyons, littered with gigantic boulders. He had not seen a single horizontal area larger than a tennis court -and the red line on the propellant gauge was only thirty seconds away.

But there, at last, was a smooth surface - much the flattest he'd seen - it was his only chance within the time frame.

Delicately, he juggled the giant, unstable cylinder he was controlling towards the patch of horizontal ground - it seemed to be snow-covered - yes, it was - the blast was blowing the snow away - but what's underneath? - looks like ice - must be a frozen lake - how thick? - HOW THICK? -The five-hundred-ton hammer-blow of Galaxy's main jets hit the treacherously inviting surface. A pattern of radiating lines sped swiftly across it; the ice cracked, and great sheets started to overturn. Concentric waves of boiling water hurtled outwards as the fury of the drive blasted into the suddenly uncovered lake.

Like the well-trained officer he was, Chang reacted automatically, without the fatal hesitations of thought. His left hand ripped open the SAFETY LOCK bar; his right grabbed the red lever it protected - and pulled it to the open position.

The ABORT program, peacefully sleeping ever since Galaxy was launched, took over and hurled the ship back up into the sky.

30
Galaxy Down

In the wardroom, the sudden surge of full thrust came like a stay of execution. The horrified officers had seen the collapse of the chosen landing site, and knew that there was only one way of escape. Now that Chang had taken it, they once more permitted themselves the luxury of breath.

But how long they could continue to enjoy that experience, no-one could guess. Only Chang knew whether the ship had enough propellant to reach a stable orbit; and even if it did, Captain Laplace thought gloomily, the lunatic with the gun might order him down again. Though he did not for a minute believe that she really was a lunatic; she knew exactly what she was doing.

Suddenly, there was a change in thrust.

'Number Four motor's just cut,' said an engineering officer. 'I'm not surprised - probably overheated. Not rated for so long at this level.'

There was, of course, no sense of any directional change - the reduced thrust was still along the ship's axis - but the views on the monitor screens had tilted crazily. Galaxy was still ascending, but no longer vertically. She had become a ballistic missile, aimed at some unknown target on Europa.

Once more, the thrust dropped abruptly; across the video monitors, the horizon became level again.

'He's cut the opposite motor - only way to stop us cartwheeling - but can he maintain altitude - good man!'

The watching scientists could not see what was good about it; the view on the monitors had disappeared completely, obscured by a blinding white fog.

'He's dumping excess propellant - lightening the ship -'

The thrust dwindled away to zero; the ship was in free fall. In a few seconds, it had dropped through the vast cloud of ice crystals created when its dumped propellant had exploded into space. And there beneath it, approaching at a leisurely one-eighth of a gravity acceleration, was Europa's central sea. At least Chang would not have to select a landing site; from now on, it would be standard operating procedure, familiar as a video game to millions who had never gone into space, and never would.

All you had to do was to balance the thrust against gravity, so that the descending ship reached zero velocity at zero altitude. There was some margin for error, but not much, even for the water landings which the first American astronauts had preferred, and which Chang was now reluctantly emulating. If he made a mistake - and after the last few hours, he could scarcely be blamed - no home computer would say to him: 'Sorry - you've crashed. Would you like to try again? Answer YES/NO...'

Second Officer Yu and his two companions, waiting with their improvised weapons outside the locked door of the bridge, had perhaps been given the toughest assignment of all. They had no monitor screens to tell them what was happening, and had to rely on messages from the wardroom. Nor had there been anything through the spy mike, which was hardly surprising. Chang and McCullen had very little time or need for conversation.

The touchdown was superb, with hardly a jolt. Galaxy sank a few extra metres, then bobbed up again, to float vertically and - thanks to the weight of the engines - in the upright position.

It was then that the listeners heard the first intelligible sounds through the spy mike.

'You maniac, Rosie,' said Chang's voice, more in resigned exhaustion than anger. 'I hope you're satisfied. You've killed us all.'

There was one pistol shot, then a long silence.

Yu and his colleagues waited patiently, knowing that something was bound to happen soon. Then they heard the locking levers being unlatched, and gripped the spanners and metal bars they were carrying. She might get one of them, but not all -The door swung open, very slowly.

'Sorry,' said Second Officer Chang. 'I must have passed out for a minute.'

Then, like any reasonable man, he fainted again.

31
The Sea of Galilee

I can never understand how a man could become a doctor, Captain Laplace told himself. Or an undertaker, for that matter. They have some nasty jobs to do...

'Well, did you find anything?'

'No, Skipper. Of course, I don't have the right sort of equipment. There are some implants that you could only locate through a microscope - or so I'm told. They could only be very short range, though.'

'Perhaps to a relay transmitter somewhere in the ship - Floyd's suggested we make a search. You took fingerprints and - any other idents?'

'Yes - when we contact Ganymede, we'll beam them up, with her papers. But I doubt if we'll ever know who Rosie was, or who she was acting for. Or why, for God's sake.'

'At least she showed some human instincts,' said Laplace thoughtfully. 'She must have known she'd failed, when Chang pulled the ABORT lever. She could have shot him then, instead of letting him land.'

'Much good that will do us, I'm afraid. Let me tell you something that happened when Jenkins and I put the cadaver out through the refuse dump.'

The doctor pursed his lips in a grimace of distaste.

'You were right, of course - it was the only thing to do. Well, we didn't bother to attach any weights - it floated for a few minutes - we watched to see if it would clear the ship - and then...'

The doctor seemed to be struggling for words.

'What, dammit?'

'Something came up out, of the water, Like a parrot beak, but about a hundred times bigger. It took - Rosie - with one snap, and disappeared. We have some impressive company here; even if we could breathe outside, I certainly wouldn't recommend swimming -'

'Bridge to Captain,' said the officer on duty, 'Big disturbance in the water - camera three - I'll give you the picture.'

'That's the thing I saw!' cried the doctor. He felt a sudden chill at the inevitable, ominous thought: I hope it's not back for more.

Suddenly, a vast bulk broke through the surface of the ocean and arched into the sky. For a moment, the whole monstrous shape was suspended between air and water.

The familiar can be as shocking as the strange - when it is in the wrong place. Both captain and doctor exclaimed simultaneously: 'It's a shark!'

There was just time to notice a few subtle differences - in addition to the monstrous parrot-beak - before the giant crashed back into the sea. There was an extra pair of fins - and there appeared to be no gills. Nor were there any eyes, but on either side of the beak there were curious protuberances that might be some other sense organs.

'Convergent evolution, of course,' said the doctor. 'Same problems, same solutions, on any planet. Look at Earth. Sharks, dolphins, ichthyosaurs - all oceanic predators must have the same basic design. That beak puzzles me, though -'

'What's it doing now?'

The creature had surfaced again, but now it was moving very slowly, as if exhausted after that one gigantic leap. In fact, it seemed to be in trouble - even in agony; it was beating its tail against the sea, without attempting to move in any definite direction.

Suddenly, it vomited its last meal, turned belly up, and lay wallowing lifelessly in the gentle swell.

'Oh my God,' whispered the Captain, his voice full of revulsion. 'I think I know what's happened.'

'Totally alien biochemistries,' said the doctor; even he seemed shaken by the sight. 'Rosie's claimed one victim, after all.'

The Sea of Galilee was, of course, named after the man who had discovered Europa - as he in turn had been named after a much smaller sea on another world.

It was a very young sea, being less than fifty years old; and, like most new-born infants, could be quite boisterous. Although the Europan atmosphere was still too thin to generate real hurricanes, a steady wind blew from the surrounding land towards the tropical zone at the point above which Lucifer was stationary. Here, at the point of perpetual noon, the water was continually boiling - though at a temperature, in this thin atmosphere, barely hot enough to make a good cup of tea.

Luckily, the steamy, turbulent region immediately beneath Lucifer was a thousand kilometres away; Galaxy had descended in a relatively calm area, less than a hundred kilometres from the nearest land. At peak velocity, she could cover that distance in a fraction of a second; but now, as she drifted beneath the low-hanging clouds of Europa's permanent overcast, land seemed as far-off as the remotest quasar. To make matters worse - if possible - the eternal off-shore wind was taking her further out to sea. And even if she could manage to ground herself on some virgin beach of this new world, she might be no better off than she was now.

But she would be more comfortable; spaceships, though admirably watertight, are seldom seaworthy. Galaxy was floating in a vertical position, bobbing up and down with gentle but disturbing oscillations; half the crew was already sick.

Captain Laplace's first action, after he had been through the damage reports, was to appeal for anyone with experience in handling boats - of any

size or shape. It seemed reasonable to suppose that among thirty astronautical engineers and space scientists there should be a considerable amount of seafaring talent, and he immediately located five amateur sailors and even one professional - Purser Frank Lee who had started his career with the Tsung shipping lines and then switched to space.

Although pursers were more accustomed to handling accounting machines (often, in Frank Lee's case, a two-hundred-year-old ivory abacus) than navigational instruments, they still had to pass exams in basic seamanship. Lee had never had a chance of testing his maritime skills; now, almost a billion kilometres from the South China Sea, his time had come.

'We should flood the propellant tanks,' he told the Captain. 'Then we'll ride lower and won't be bobbing up and down so badly.'

It seemed foolish to let even more water into the ship, and the Captain hesitated.

'Suppose we run aground?'

No one made the obvious comment 'What difference will it make?' Without any serious discussion, it had been assumed that they would be better off on land - if they could ever reach it.

'We can always blow the tanks again. We'll have to do that anyway, when we reach shore, to get the ship into a horizontal position. Thank God we have power...'

His voice trailed off; everyone knew what he meant. Without the auxiliary reactor which was now running the life-support systems, they would all be dead within hours. Now - barring a breakdown - the ship could sustain them indefinitely.

Ultimately, of course, they would starve; they had just had dramatic proof that there was no nourishment, but only poison, in the seas of Europa.

At least they had made contact with Ganymede, so that the entire human race now knew their predicament. The best brains in the Solar System would now be trying to save them. If they failed, the passengers and crew of Galaxy would have the consolation of dying in the full glare of publicity.

IV
AT THE WATER HOLE

32
Diversion

'The latest news,' said Captain Smith to his assembled passengers, 'is that Galaxy is afloat, and in fairly good condition. One crew member - a woman steward - has been killed - we don't know the details - but everyone else is safe.

'The ship's systems are all working; there are a few leaks, but they've been controlled. Captain Laplace says there's no immediate danger, but the prevailing wind is driving them further away from the mainland, towards the centre of dayside. That's not a serious problem - there are several large islands they're virtually certain to reach first. At the moment they're ninety kilometres from the nearest land. They've seen some large marine animals, but they show no sign of hostility.

'Barring further accidents, they should be able to survive for several months, until they run out of food - which of course is now being strictly rationed. But according to Captain Laplace, morale is still high.

'Now, this is where we come in. If we return to Earth immediately, get refuelled and refitted, we can reach Europa in a retrograde, powered orbit in eighty-five days. Universe is the only ship currently commissioned that can land there and take off again with a reasonable payload. The Ganymede shuttles may be able to drop supplies, but that's all - though it may make the difference between life and death.

'I'm sorry, ladies and gentlemen, that our visit has been cut short - but I think you'll agree that we've shown you everything we promised. And I'm sure you'll approve of our new mission - even though the chances of success are, frankly, rather slim. That's all for the moment. Dr Floyd, can I have a word with you?'

As the others drifted slowly and thoughtfully from the main lounge - scene of so many less portentous briefings - the Captain scanned a clipboard full of messages. There were still occasions when words printed on pieces of paper were the most convenient medium of communication, but even here technology had made its mark. The sheets that the Captain was reading were made of the indefinitely reusable multifax material which had done so much to reduce the load on the humble wastepaper basket.

'Heywood,' he said - now that the formalities were over - 'as you can guess, the circuits are burning up. And there's a lot going on that I don't understand.'

'Ditto,' answered Floyd. 'Anything from Chris yet?'

"No, but Ganymede's relayed your message; he should have had it by now. There's a priority override on private communications, as you can imagine - but of course your name overrode that.'

'Thanks, Skipper. Anything I can do to help?'

'Not really - I'll let you know.'

It was almost the last time, for quite a while, that they would be on speaking terms with each other. Within a few hours Dr Heywood Floyd would become 'That crazy old fool!', and the short-lived 'Mutiny on the Universe' would have begun - led by the Captain.

It was not actually Heywood Floyd's idea; he only wished it was.

Second Officer Roy Jolson was 'Stars', the navigation officer; Floyd barely knew him by sight, and had never had occasion to say more than good morning to him. He was quite surprised, therefore, by the diffident knock on his cabin door.

The astrogator was carrying a set of charts, and seemed a little ill at ease. He could not be overawed by Floyd's presence - everyone on board now took him for granted - so there must be some other reason.

'Dr Floyd,' he began, in a tone of such urgent anxiety that he reminded his listener of a salesman whose entire future depends on making the next deal. 'I'd like your advice - and assistance.'

'Of course - but what can I do?'

Jolson unrolled the chart showing the position of all the planets inside the orbit of Lucifer.

'Your old trick of coupling Leonov and Discovery, to escape from Jupiter before it blew up, gave me the idea.'

'It wasn't mine. Walter Curnow thought of it.'

'Oh - I never knew that. Of course, we don't have another ship to boost us here - but we have something much better.'

'What do you mean?' asked Floyd, completely baffled.

'Don't laugh. Why go back to Earth to take on propellant - when Old Faithful is blasting out tons every second, a couple of hundred metres away? If we tapped that, we could get to Europa not in three months - but in three weeks.'

The concept was so obvious, yet so daring, that it took Floyd's breath away. He could see half a dozen objections instantly; but none of them seemed fatal.

'What does the Captain think of the idea?'

'I've not told him; that's why I need your help. I'd like you to check my calculations - then put the idea to him. He'd turn me down - I'm quite certain - and I don't blame him. If I was captain, I think I would too...'

There was a long silence in the little cabin. Then Heywood Floyd said slowly: 'Let me give you all the reasons why it can't be done. Then you can tell me why I'm wrong.'

Second Officer Jolson knew his commander; Captain Smith had never heard such a crazy suggestion in his life.

His objections were all well-founded, and showed little, if any, trace of the notorious 'not invented here' syndrome.

'Oh, it would work in theory,' he admitted. 'But think of the practical problems, man! How would you get the stuff into the tanks?'

'I've talked to the engineers. We'd move the ship to the edge of the crater - it's quite safe to get within fifty metres. There's plumbing in the unfurnished section we can rip out - then we'd run a line to Old Faithful and wait until he spouts; you know how reliable and well-behaved he is.'

'But our pumps can't operate in a near vacuum!'

'We don't need them; we can rely on the geyser's own efflux velocity to give us an input of at least a hundred kilos a second. Old Faithful will do all the work.'

'He'll just give ice crystals and steam, not liquid water.'

'It will condense when it gets on board.'

'You've really thought this out, haven't you?' said the Captain with grudging admiration. 'But I just don't believe it. Is the water pure enough, for one thing? What about contaminants - especially carbon particles?'

Floyd could not help smiling. Captain Smith was developing an obsession about soot...

'We can filter out large ones; the rest won't affect the reaction. Oh yes - the hydrogen isotope ratio here looks better than for Earth. You may even get some extra thrust.'

'What do your colleagues think of the idea? If we head straight for Lucifer, it may be months before they can get home...

'I've not spoken to them. But does it matter, when so many lives are at stake? We may reach Galaxy seventy days ahead of schedule! Seventy days! Think what could happen on Europa in that time!'

'I'm perfectly aware of the time factor,' snapped the Captain. 'That applies to us as well. We may not have provisions for such an extended trip.'

Now he's straining at gnats, thought Floyd - and he must know that I know it. Better be tactful...

'An extra couple of weeks? I can't believe we have so narrow a margin. You've been feeding us too well, anyway. Do some of us good to be on short rations for a while.'

The Captain managed a frosty smile.

'You can tell that to Willis and Mihailovich. But I'm afraid the whole idea is insane.'

'At least let us try it on the owners. I'd like to speak to Sir Lawrence.'

'I can't stop you, of course,' said Captain Smith, in a tone that suggested he wished he could. 'But I know exactly what he'll say.'

He was quite wrong.

Sir Lawrence Tsung had not placed a bet for thirty years; it was no longer in keeping with his august position in the world of commerce. But as a young man he had often enjoyed a mild flutter at the Hong Kong Race Course, before a puritanical administration had closed it in a fit of public morality. It was typical of life, Sir Lawrence sometimes thought wistfully, that when he could bet he had no money - and now he couldn't, because the richest man in the world had to set a good example.

And yet, as nobody knew better than he did, his whole business career had been one long gamble. He had done his utmost to control the odds, by gathering the best information and listening to the experts his hunches told him would give the wisest advice. He had usually pulled out in time when they were wrong; but there had always been an element of risk.

Now, as he read the memorandum from Heywood Floyd, he felt again the old thrill he had not known since he had watched the horses thundering round into the last lap. Here was a gamble indeed - perhaps the last and greatest of his career - though he would never dare tell his Board of Directors. Still less the Lady Jasmine.

'Bill,' he said, 'what do you think?'

His son (steady and reliable, but lacking that vital spark which was perhaps no longer needed in this generation) gave him the answer he expected.

'The theory is quite sound. Universe can do it - on paper. But we've lost one ship. We'll be risking another.'

'She's going to Jupiter - Lucifer - anyway.'

'Yes - but after a complete checkout in Earth orbit. And do you realize what this proposed direct mission will involve? She'll be smashing all speed records - doing over a thousand kilometres a second at turnaround!'

It was the worst thing he could possibly have said; once again the thunder of hooves sounded in his father's ears.

But Sir Lawrence merely answered: 'It won't do any harm for them to make some tests, though Captain Smith is fighting the idea tooth and nail. Even threatens to resign. Meanwhile, just check the position with Lloyd's - we may have to back down on the Galaxy claim.'

Especially, he might have added, if we're going to throw Universe on to the table, as an even bigger chip.

And he was worried about Captain Smith. Now that Laplace was stranded on Europa, he was the best commander he had left.

33
Pit Stop

'Sloppiest job I've seen since I left college,' grumbled the Chief Engineer. 'But it's the best we can do in the time.'

The makeshift pipeline stretched across fifty metres of dazzling, chemical-encrusted rock to the now quiescent vent of Old Faithful, where it ended in a rectangular, downward-pointing funnel. The sun had just risen over the hills, and already the ground had begun to tremble slightly as the geyser's subterranean - or subhallean - reservoirs felt the first touch of warmth.

Watching from the observation lounge, Heywood Floyd could hardly believe that so much had happened in a mere twenty-four hours. First of all, the ship had split into two rival factions - one led by the Captain, the other perforce headed by himself. They had been coldly polite to each other, and there had been no actual exchange of blows; but he had discovered that in certain quarters he now rejoiced in the nickname of 'Suicide' Floyd. It was not an honour that he particularly appreciated.

Yet no-one could find anything fundamentally wrong with the Floyd-Jolson manoeuvre. (That name was also unfair: he had insisted that Jolson get all the credit, but no-one had listened. And Mihailovich had said: 'Aren't you prepared to share the blame?')

The first test would be in twenty minutes, when Old Faithful, rather belatedly, greeted the dawn. But even if that worked, and the propellant tanks started to fill with sparkling pure water rather than the muddy slurry Captain Smith had predicted, the road to Europa was still not open.

A minor, but not unimportant, factor was the wishes of the distinguished passengers. They had expected to be home within two weeks; now, to their surprise and in some cases consternation, they were faced with the prospect of a dangerous mission halfway across the Solar System - and, even if it succeeded, no firm date for a return to Earth.

Willis was distraught; all his schedules would be totally wrecked. He drifted around muttering about lawsuits, but no-one expressed the slightest sympathy.

Greenburg, on the other hand, was ecstatic; now he would really be in the space business again! And Mihailovich - who spent a lot of time noisily composing in his far from soundproof cabin - was almost equally delighted. He was sure that the diversion would inspire him to new heights of creativity.

Maggie M was philosophical: 'If it can save a lot of lives,' she said, looking pointedly at Willis, 'how can anyone possibly object?'

As for Yva Merlin, Floyd made a special effort to explain matters to her, and discovered that she understood the situation remarkably well. And it was Yva, to his utter astonishment, who asked the question to which no-one else seemed to have paid much attention: 'Suppose the Europans don't want us to land - even to rescue our friends?'

Floyd looked at her in frank amazement; even now, he still found it difficult to accept her as a real human being, and never knew when she would come out with some brilliant insight or utter stupidity.

'That's a very good question, Yva. Believe me, I'm working on it.'

He was telling the truth; he could never lie to Yva Merlin. That, somehow, would be an act of sacrilege.

The first wisps of vapour were appearing over the mouth of the geyser. They shot upwards and away in their unnatural vacuum trajectories, and evaporated swiftly in the fierce Sunlight.

Old Faithful coughed again, and cleared its throat. A snowy-white - and surprisingly compact - column of ice crystals and water droplets climbed swiftly towards the sky. All one's terrestrial instincts expected it to topple and fall, but of course it did not. It continued onwards and upwards, spreading only slightly, until it merged into the vast, glowing envelope of the comet's still expanding coma. Floyd noted, with satisfaction, that the pipeline was beginning to shake as fluid rushed into it.

Ten minutes later, there was a council of war on the bridge. Captain Smith, still in a huff, acknowledged Floyd's presence with a slight nod; his Number Two, a little embarrassed, did all the talking.

'Well, it works, surprisingly well. At this rate, we can fill our tanks in twenty hours - though we may have to go out and anchor the pipe more securely.'

'What about the dirt?' someone asked.

The First Officer held up a transparent squeeze-bulb holding a colourless liquid.

'The filters got rid of everything down to a few microns, To be on the safe side, we'll run through them twice, cycling from one tank to another. No swimming pool, I'm afraid, until we pass Mars.'

That got a much needed laugh, and even the Captain relaxed a little.

'We'll run up the engines, at minimum thrust, to check that there are no operational anomalies with Halley H20. If there are, we'll forget the whole idea, and head home on good old Moon water, fob Aristarchus.'

There was one of those 'party silences' where everyone waits simultaneously for someone else to speak. Then Captain Smith broke the embarrassing hiatus.

'As you all know,' he said, 'I'm very unhappy with the whole idea. In fact - ' he changed course abruptly; it was equally well-known that he had considered sending Sir Lawrence his resignation, though in the circumstances that would have been a somewhat pointless gesture.

'But a couple of things have happened in the last few hours. The owner agrees with the project - if no fundamental objections emerge from our tests. And - this is the big surprise, and I don't know any more about it than you do - the World Space Council has not only okayed but requested that we make the diversion, underwriting any expenses incurred. Your guess is as good as mine...

'But I still have one worry -' he looked doubtfully at the little bulb of water, which Heywood Floyd was now holding up to the light and shaking gently. 'I'm an engineer, not a damn chemist. This stuff looks clean - but what will it do to the tank linings?'

Floyd never quite understood why he acted as he did; such rashness was completely uncharacteristic. Perhaps he was simply impatient with the whole debate, and wanted to get on with the job. Or perhaps he felt that the Captain needed a little stiffening of the moral fibre.

With one quick movement, he flicked open the stopcock and squirted approximately 20cc of Halley's Comet down his throat.

'There's your answer, Captain,' he said, when he had finished swallowing.

'And that,' said the ship's doctor half an hour later, 'was one of the silliest exhibitions I've ever seen. Don't you know that there are cyanides and cyanogens and God knows what else in that stuff?'

'Of course, I do,' laughed Floyd. 'I've seen the analyses - just a few parts in a million. Nothing to worry about, But I did have one surprise,' he added ruefully.

'And what was that?'

'If you could ship this stuff back to Earth, you could make a fortune selling it as Halley's Patent Purgative.'

34
Car Wash

Now that they were committed, the whole atmosphere aboard Universe had changed. There was no more argument; everyone was cooperating to the utmost, and very few people had much sleep for the next two rotations of the nucleus - a hundred hours of Earth time.

The first Halley 'day' was devoted to a still rather cautious tapping of Old Faithful, but when the geyser subsided towards nightfall the technique had been thoroughly mastered. More than a thousand tons of water had been taken aboard; the next period of daylight would be ample for the rest.

Heywood Floyd kept out of the Captain's way, not wishing to press his luck; in any event, Smith had a thousand details to attend to. But the calculation of the new orbit was not among them; that had been checked and rechecked on Earth.

There was no doubt, now, that the concept was brilliant, and the savings even greater than Jolson had claimed. By refuelling on Halley, Universe had eliminated the two major orbit changes involved in the rendezvous with Earth; she could now go straight to her goal, under maximum acceleration, saving many weeks. Despite the possible risks, everyone now applauded the scheme.

Well, almost everyone.

On Earth, the swiftly organized 'Hands off Halley!' society was indignant. Its members (a mere 236, but they knew how to drum up publicity) did not consider the rifling of a celestial body justified, even to save lives. They

refused to be placated even when it was pointed out that Universe was merely borrowing material that the comet was about to lose anyway. It was, they argued, the principle of the thing. Their angry communiqués gave much needed light relief aboard Universe.

Cautious as ever, Captain Smith ran the first low-powered tests with one of the attitude-control thrusters; if this became unserviceable, the ship could manage without it, There were no anomalies; the engine behaved exactly as if it was running on the best distilled water from the lunar mines.

Then he tested the central main engine, Number One; if that was damaged, there would be no loss of manoeuvrability - only of total thrust. The ship would still be fully controllable, but, with the four remaining outboards alone, peak acceleration would be down by twenty per cent.

Again, there were no problems; even the sceptics started being polite to Heywood Floyd, and Second Officer Jolson was no longer a social outcast.

The lift-off was scheduled late in the afternoon, just before Old Faithful was due to subside. (Would it still be there to greet the next visitors in seventy-six years' time? Floyd wondered. Perhaps; there were hints of its existence even back on the 1910 photographs.)

There was no countdown, in the dramatic oldtime Cape Canaveral style. When he was quite satisfied that everything was shipshape, Captain Smith applied a mere five tons of thrust on Number One, and Universe drifted slowly upwards and away from the comet.

The acceleration was modest, but the pyrotechnics were awe-inspiring - and, to most of the watchers, wholly unexpected. Until now, the jets from the main engines had been virtually invisible, being formed entirely of highly ionized oxygen and hydrogen. Even when - hundreds of kilometres away - the gases had cooled off enough to combine chemically, there was still nothing to be seen, because the reaction gave no light in the visible spectrum.

But now, Universe was climbing away from Halley on a column of incandescence too brilliant for the eye to look upon; it seemed almost a solid pillar of flame. Where it hit the ground, rock exploded upwards and outwards; as it departed for ever, Universe was carving its signature, like cosmic graffiti, across the nucleus of Halley's Comet.

Most of the passengers, accustomed to climbing spacewards with no visible means of support, reacted with considerable shock. Floyd waited for the inevitable explanation; one of his minor pleasures was catching Willis in some scientific error, but this very seldom happened. And even when it did, Willis always had some very plausible excuse.

'Carbon,' he said. 'Incandescent carbon - exactly as in a candle flame - but slightly hotter.'

'Slightly,' murmured Floyd.

'We're no longer burning - if you'll excuse the word -, (Floyd shrugged his shoulders) 'pure water. Although it's been carefully filtered, there's a lot of colloidal carbon in it. As well as compounds that could only be removed by distillation.'

'It's very impressive, but I'm a little worried,' said Greenburg. 'All that radiation - won't it affect the engines - and heat the ship badly?'

It was a very good question, and it had caused some anxiety. Floyd waited for Willis to handle it; but that shrewd operator bounced the ball right back to him.

'I'd prefer Dr Floyd to deal with that - after all, it was his idea.'

'Jolson's, please. Good point, though. But it's no real problem; when we're under full thrust, all those fireworks will be a thousand kilometres behind us. We won't have to worry about them.'

The ship was now hovering some two kilometres above the nucleus; had it not been for the glare of the exhaust, the whole sunlit face of the tiny world would have been spread out beneath. At this altitude - or distance - the column of Old Faithful had broadened slightly. It looked, Floyd suddenly recalled, like one of the giant fountains ornamenting Lake Geneva. He had not seen them for fifty years, and wondered if they still played there.

Captain Smith was testing the controls, slowly rotating the ship, then pitching and yawing it along the Y and Z axes. Everything seemed to be functioning perfectly.

'Mission time zero is ten minutes from now,' he announced. '0.1 gee for fifty hours; then 0.2 until turnaround - one hundred and fifty hours from now.' He paused to let that sink in; no other ship had ever attempted to maintain so high a continuous acceleration, for so long. If Universe was not able to brake properly, she would also enter the history books as the first manned interstellar voyager.

The ship was now turning towards the horizontal - if that word could be used in this almost gravityless environment - and was pointing directly to the white column of mist and ice crystals still steadily spurting from the comet. Universe started to move towards it -

'What's he doing?' said Mihailovich anxiously.

Obviously anticipating such questions, the Captain spoke again. He seemed to have completely recovered his good humour, and there was a hint of amusement in his voice.

'Just one little chore before we leave, Don't worry - I know exactly what I'm doing. And Number Two agrees with me - don't you?'

'Yessir - though I thought you were joking at first.'

'What is going on up on the bridge?' asked Willis, for once at a loss.

Now the ship was starting a slow roll, while still moving at no more than a good walking speed towards the geyser. From this distance - now less than a hundred metres - it reminded Floyd still more closely of those far-off Geneva fountains.

Surely he's not taking us into it - But he was. Universe vibrated gently as it nuzzled its way into the rising column of foam. It was still rolling very

slowly, as if it was drilling its way into the giant geyser. The video monitors and observation windows showed only a milky blankness.

The whole operation could not have lasted more than ten seconds; then they were out on the other side. There was a brief burst of spontaneous clapping from the officers on the bridge; but the passengers - even including Floyd - still felt somewhat put-upon.

'Now we're ready to go,' said the Captain, in tones of great satisfaction. 'We have a nice, clean ship again.'

During the next half-hour, more than ten thousand amateur observers on Earth and Moon reported that the comet had doubled its brightness. The Comet Watch Network broke down completely under the overload, and the professional astronomers were furious.

But the public loved it, and a few days later Universe put on an even better show, a few hours before dawn.

The ship, gaining speed by more than ten thousand kilometres an hour, every hour, was now far inside the orbit of Venus. It would get even closer to the sun before it made its perihelion passage - far more swiftly than any natural celestial body - and headed out towards Lucifer.

As it passed between Earth and Sun, the thousand kilometre tail of incandescent carbon was easily visible as a fourth magnitude star, showing appreciable movement against the constellations of the morning sky in the course of a single hour. At the very beginning of its rescue mission, Universe would be seen by more human beings, at the same moment, than any artefact in the history of the world.

35
Adrift

The unexpected news that their sister ship Universe was on the way - and might arrive far sooner than anyone had dared to dream - had an effect upon the morale of Galaxy's crew that could only be called euphoric. The mere fact that they were drifting helplessly on a strange ocean, surrounded by unknown monsters, suddenly seemed of minor importance.

As did the monsters themselves, though they made interesting appearances from time to time. The giant 'sharks' were sighted occasionally, but never came near the ship, even when garbage was dumped overboard. This was quite surprising; it strongly suggested that the great beasts - unlike their terrestrial counterparts - had a good system of communication. Perhaps they were more closely allied to dolphins than to sharks.

There were many schools of smaller fish, which no-one would have given a second glance in a market on Earth. After several attempts, one of the officers - a keen angler - managed to catch one with an unbaited hook. He never brought

it in through the airlock - the Captain would not have permitted it, anyway - but measured and photographed it carefully before returning it to the sea.

The proud sportsman had to pay a price for his trophy, however. The partial-pressure spacesuit he had worn during the exercise had the characteristic 'rotten eggs' stink of hydrogen sulphide when he brought it back into the ship, and he became the butt of innumerable jokes. It was yet another reminder of an alien, and implacably hostile, biochemistry.

Despite the pleas of the scientists, no further angling was allowed. They could watch and record, but not collect, And anyway, it was pointed out, they were planetary geologists, not naturalists. No-one had thought of bringing formalin - which probably would not work here in any event.

Once, the ship drifted for several hours through floating mats or sheets of some bright green material. It formed ovals, about ten metres across, and all of approximately the same size, Galaxy ploughed through them without resistance, and they swiftly reformed behind her. It was guessed that they were colonial organisms of some kind.

And one morning, the officer of the watch was startled when a periscope rose out of the water and he found himself staring into a mild, blue eye which, he said when he had recovered, looked like a sick cow's. It regarded him sadly for a few moments, without much apparent interest, then slowly returned to the ocean,

Nothing seemed to move very fast here, and the reason was obvious. This was still a low-energy world - there was none of the free oxygen that allowed the animals of Earth to live by a series of continuous explosions, from the moment they started to breathe at birth. Only the 'shark' of that first encounter had shown any sign of violent activity - in its last, dying spasm.

Perhaps that was good news for men. Even if they were encumbered with spacesuits, there was probably nothing on Europa that could catch them -even if it wanted to.

Captain Laplace found wry amusement in handing over the operation of his ship to the purser; he wondered if this situation was unique, in the annals of space and sea.

Not that there was a great deal that Mr Lee could do. Galaxy was floating vertically, one-third out of the water, heeling slightly before a wind that was driving it at a steady five knots. There were only a few leaks below the waterline, easily handled. Equally important, the hull was still airtight.

Although most of the navigation equipment was useless, they knew exactly where they were. Ganymede gave them an accurate fix on their emergency beacon every hour, and if Galaxy kept to her present course she would make landfall on a large island within the next three days. If she missed that, she would head on out to the open sea, and eventually reach the tepidly boiling zone immediately underneath Lucifer. Though not necessarily catastrophic, that was a most unattractive prospect; Acting Captain Lee spent much of his time thinking of ways to avoid it.

Sails - even if he had suitable material and rigging - would make very little difference to their course. He had lowered improvised sea-anchors down to five hundred metres, looking for currents that might be useful, and finding none. Nor had he found the bottom; it lay unknown kilometres further down.

Perhaps that was just as well; it protected them from the submarine quakes that continually. racked this new ocean. Sometimes Galaxy would shake as if struck by a giant hammer, as a shockwave went racing by. In a few hours, a tsunami, dozens of metres high, would crash upon some Europan shore; but here in deep water the deadly waves were little more than ripples.

Several times, sudden vortexes were observed at a distance; they looked quite dangerous - maelstroms that might even suck Galaxy down to unknown depths - but luckily they were too far off to do more than make the ship spin around a few times in the water.

And just once, a huge bubble of gas rose and burst only a hundred metres away. It was most impressive, and everyone seconded the doctor's heartfelt comment: 'Thank God we can't smell it.'

It is surprising how quickly the most bizarre situation can become routine. Within a few days, life aboard Galaxy had settled down to a steady routine, and Captain Laplace's main problem was keeping the crew occupied. There was nothing worse for morale than idleness, and he wondered how the skippers of the old windjammers had kept their men busy on those interminable voyages. They couldn't have spent all their time scrambling up the rigging or cleaning the decks.

He had the opposite problem with the scientists. They were always proposing tests and experiments, which had to be carefully considered before they could be approved. And if he allowed it, they would have monopolized the ship's now very limited communications channels.

The main antenna complex was now being battered around at the waterline, and Galaxy could no longer talk directly to Earth. Everything had to be relayed through Ganymede, on a bandwidth of a few miserable megahertz. A single live video channel pre-empted everything else, and he had to resist the clamour of the terrestrial networks. Not that they would have a great deal to show their audiences, except open sea, cramped ship interiors, and a crew which, though in good spirits, was becoming steadily more hirsute.

An unusual amount of traffic seemed directed to Second Officer Floyd whose encrypted responses were so brief that they could not have contained much information. Laplace finally decided to have a talk to the young man.

'Mr Floyd,' he said, in the privacy of his cabin. 'I'd appreciate it if you would enlighten me about your part-time occupation.'

Floyd looked embarrassed, and clutched at the table as the ship rocked slightly in a sudden gust.

'I wish I could, sir, but I'm not permitted.'

'By whom, may I ask?'

'Frankly, I'm not sure.'

That was perfectly true. He suspected it was ASTROPOL, but the two quietly impressive gentlemen who had briefed him on Ganymede had unaccountably failed to provide this information.

'As captain of this ship - especially in the present circumstances - I would like to know what's going on here. If we get out of this, I'm going to spend the next few years of my life at Courts of Enquiry. And you'll probably be doing the same.'

Floyd managed a wry grin.

'Hardly worth being rescued, is it, Sir? All I know is that some high-level agency expected trouble on this mission, but didn't know what form it would take. I was just told to keep my eyes open. I'm afraid I didn't do much good, but I imagine I was the only qualified person they could get hold of in time.'

'I don't think you can blame yourself. Who would have imagined that Rosie -'

The Captain paused, struck by a sudden thought.

'Do you suspect anyone else?' He felt like adding 'Me, for instance?', but the situation was already sufficiently paranoiac.

Floyd looked thoughtful, then apparently came to a decision.

'Perhaps I should have spoken to you before, Sir, but I know how busy you've been. I'm sure Dr van der Berg is involved somehow. He's a Mede, of course; they're odd people, and I don't really understand them.' Or like them, he might have added. Too clannish - not really friendly to offworlders. Still, one could hardly blame them; all pioneers trying to tame a new wilderness were probably much the same.

'Van der Berg - hmm. What about the other scientists?'

'They've been checked, of course. All perfectly legitimate, and nothing unusual about any of them.'

That was not altogether true. Dr Simpson had more wives than was strictly legal, at least at one time, and Dr Higgins had a large collection of most curious books. Second Officer Floyd was not quite sure why he had been told all this; perhaps his mentors merely wanted to impress him with their omniscience. He decided that working for ASTROPOL (or whoever it was) had some entertaining fringe benefits.

'Very well,' said the Captain, dismissing the amateur agent. 'But please keep me informed if you discover anything - anything at all- that might affect the safety of the ship.'

In the present circumstances, it was hard to imagine what that might be. Any further hazards seemed slightly superfluous.

Even twenty-four hours before they sighted the island, it was still not certain whether Galaxy would miss it and be blown on out into the emptiness of the central ocean. Her position, as observed by the Ganymede radar, was plotted on a large chart which everyone aboard examined anxiously several times a day.

Even if the ship did reach land, her problems might be just beginning. She might be pounded to pieces on a rocky coast, rather than gently deposited on some conveniently shelving beach.

Acting Captain Lee was keenly aware of all these possibilities. He had once been shipwrecked himself, in a cabin cruiser whose engines had failed at a critical moment, off the island of Bali. There had been little danger, though a good deal of drama, and he had no wish to repeat the experience - especially as there was no coastguard here to come to the rescue.

There was a truly cosmic irony in their plight. Here they were, aboard one of the most advanced transportation devices ever made by man - capable of crossing the Solar System! - yet now they could not deflect it more than a few metres from its course. Nevertheless, they were not completely helpless; Lee still had a few cards to play.

On this sharply curving world, the island was only five kilometres away when they first sighted it. To Lee's great relief, there were none of the cliffs he had feared; nor, on the other hand, was there any sign of the beach he had hoped for. The geologists had warned him that he was a few million years too early to find sand here; the mills of Europa, grinding slowly, had not yet had time to do their work.

As soon as it was certain they would hit the land, Lee gave orders to pump out Galaxy's main tanks, which he had deliberately flooded soon after touchdown. Then followed a very uncomfortable few hours, during which at least a quarter of the crew took no further interest in the proceedings.

Galaxy rose higher and higher in the water, oscillating more and more wildly - then tumbled with a mighty splash, to lie along the surface, like the corpse of a whale in the bad old days when the catcher-boats pumped them full of air to stop them sinking. When he saw how the ship was lying, Lee adjusted her buoyancy again, until she was slightly stern-down, and the forward bridge was just clear of the water.

As he expected, Galaxy then swung broadside-on to the wind. Another quarter of the crew became incapacitated then, but Lee had enough helpers to get out the sea-anchor he had prepared for this final act. It was merely an improvised raft, made of empty boxes lashed together, but its drag caused the ship to point towards the approaching land.

Now they could see that they were heading - with agonizing slowness - towards a narrow stretch of beach, covered with small boulders. If they could not have sand, this was the best alternative...

The bridge was already over the beach when Galaxy grounded, and Lee played his last card. He had made only a single test-run, not daring to do more in case the abused machinery failed.

For the last time, Galaxy extended her landing gear. There was a grinding and shuddering as the pads on the underside dug their way into the alien beach. Now she was securely anchored against the winds and waves of this tideless ocean.

There was no doubt that Galaxy had found her final resting place - and, all too possibly, that of her crew.

V
THROUGH THE ASTEROIDS

37
Star

And now Universe was moving so swiftly that its orbit no longer even remotely resembled that of any natural object in the Solar System. Mercury, closest to the Sun, barely exceeds fifty kilometres a second at perihelion; Universe had reached twice that speed in the first day - and at only half the acceleration it would achieve when it was lighter by several thousand tons of water.

For a few hours, as they passed inside its orbit, Venus was the brightest of all heavenly bodies, next to the Sun and Lucifer. Its tiny disc was just visible to the naked eye, but even the ship's most powerful telescopes showed no markings whatever. Venus guarded her secrets as jealously as Europa.

By going still closer to the Sun - well inside the orbit of Mercury - Universe was not merely taking a short cut, but was also getting a free boost from the Sun's gravitational field. Because nature always balances her books, the Sun lost some velocity in the transaction; but the effect would not be measurable for a few thousand years.

Captain Smith used the ship's perihelion passage to restore some of the prestige his foot-dragging had cost him.

'Now you know,' he said, 'exactly why I flew the ship through Old Faithful. If we hadn't washed all that dirt off the hull, by this time we'd be badly overheating. In fact, I doubt if the thermal controls would have handled the load - it's already ten times Earth level.' Looking - through filters that were almost black - at the hideously swollen Sun, his passengers could easily believe him. They were all more than happy when it had shrunk back to normal size - and continued to dwindle astern as Universe sliced across the orbit of Mars, outward bound on the final leg of its mission.

The 'Famous Five' had all adjusted, in their various ways, to the unexpected change in their lives. Mihailovich was composing copiously and noisily, and was seldom seen except when he emerged at meals, to tell outrageous stories and tease all available victims, especially Willis. Greenburg had elected himself, no-one dissenting, an honorary crew member, and spent much of his time on the bridge.

Maggie M viewed the situation with rueful amusement.

'Writers,' she remarked, 'are always saying what a lot of work they could do if they were only in some place with no interruptions - no engagements; lighthouses and prisons are their favourite examples. So I can't complain - except that my requests for research material keep getting delayed by high priority messages.'

Even Victor Willis had now come to much the same conclusion; he too was busily at work on sundry long-range projects. And he had an additional reason to keep to his cabin. It would still be several weeks before he looked as if he had forgotten to shave, and months before he returned to his full glory.

Yva Merlin spent hours every day in the entertainment centre, catching up - as she readily explained - with her favourite classics. It was fortunate that Universe's library and projection facilities had been installed in time for the voyage; though the collection was still relatively small, there was sufficient for several lifetimes of viewing.

All the famous works of visual art were there, right back to the flickering dawn of the cinema. Yva knew most of them, and was happy to share her knowledge.

Floyd, of course, enjoyed listening to her, because then she became alive - an ordinary human being, not an icon. He found it both sad and fascinating that only through an artificial universe of video images could she establish contact with the real world.

One of the strangest experiences of Heywood Floyd's fairly eventful life was sitting in semi-darkness just behind Yva, somewhere outside the orbit of Mars, while they watched the original Gone with the Wind together. There were moments when he could see her famous profile silhouetted against that of Vivien Leigh, and could compare the two - though it was impossible to say that one actress was better than the other; both were sui generis.

When the lights went up, he was astonished to see that Yva was crying. He took her hand and said tenderly: 'I cried too, when Bonny died.'

Yva managed a faint smile.

'I was really crying for Vivien,' she said. 'While we were shooting Two, I read a lot about her - she had such a tragic life. And talking about her, right out here between the planets, reminds me of something that Larry said when he brought the poor thing back from Ceylon after her nervous breakdown. He told his friends: "I've married a woman from outer space."

Yva paused for a moment, and another tear trickled (rather theatrically, Floyd could not help thinking) down her cheek.

'And here's something even stranger. She made her last movie exactly a hundred years ago - and do you know what it was?'

'Go on - surprise me again.'

'I expect it will surprise Maggie - if she's really writing the book she keeps threatening us with. Vivien's very last film was - Ship of Fools.'

38
Icebergs of Space

Now that they had so much unexpected time on their hands, Captain Smith had finally agreed to give Victor Willis the long-delayed interview which was part of his contract. Victor himself had kept putting it off, owing to what Mihailovich persisted in calling his 'amputation'. As it would be many months before he could regenerate his public image, he had finally decided to do the interview off-camera; the studio on Earth could fake him in later with library shots.

They had been sitting in the Captain's still only partly furnished cabin, enjoying one of the excellent wines which apparently made up much of Victor's baggage allowance. As Universe would cut its drive and start coasting within the next few hours, this would be the last opportunity for several days. Weightless wine, Victor maintained, was an abomination; he refused to put any of his precious vintage into plastic squeezebulbs.

'This is Victor Willis, aboard the spaceship Universe at 18.30 on Friday, 15 July 2061. Though we're not yet at the mid-point of our journey, we're already far beyond the orbit of Mars, and have almost reached our maximum velocity. Which is, Captain?'

'One thousand and fifty kilometres a second.'

'More than a thousand kilometres a second -almost four million kilometres an hour!'

Victor Willis' surprise sounded perfectly genuine; no-one would have guessed that he knew the orbital parameters almost as well as did the Captain. But one of his strengths was his ability to put himself in the place of his viewers, and not only to anticipate their questions, but to arouse their interest.

'That's right,' the Captain answered with quiet pride. 'We are travelling twice as fast as any human beings since the beginning of time.'

That should have been one of my lines, thought Victor; he did not like his subject to get ahead of him. But, good professional that he was, he quickly adapted.

He pretended to consult his famous little memo pad, with its sharply directional screen whose display only he could see.

'Every twelve seconds, we're travelling the diameter of Earth. Yet it will still take us another ten days to reach Jupi - ah, Lucifer! That gives some idea of the scale of the Solar System.

'Now, Captain, this is a delicate subject, but I've had a lot of questions about it during the last week.'

Oh no, groaned Smith. Not the zero gravity toilets again!

'At this very moment, we are passing right through the heart of the asteroid belt -'

(I wish it was the toilets, thought Smith...)

'- and though no spaceship has ever been seriously damaged by a collision, aren't we taking quite a risk? After all, there are literally millions of bodies, down to the size of beachballs, orbiting in this section of space. And only a few thousand have been charted.'

'More than a few: over ten thousand.'

'But there are millions we don't know about.'

'That's true; but it wouldn't help us much if we did.'

'What do you mean?'

'There's nothing we can do about them.'

'Why not?'

Captain Smith paused for careful thought. Willis was right - this was indeed a delicate subject; Head Office would rap his knuckles smartly, if he said anything to discourage potential customers.

'First of all, space is so enormous that even here - as you said, right in the heart of the asteroid belt - the chance of collision is - infinitesimal. We've been hoping to show you an asteroid - the best we can do is Hanuman, a miserable three hundred metres across - but the nearest we get to it is a quarter of a million kilometres.'

'But Hanuman is gigantic, compared to all the unknown debris that's floating around out here. Aren't you worried about that?'

'About as worried as you are, at being struck by lightning on Earth.'

'As a matter of fact, I once had a narrow escape, on Pike's Peak in Colorado - the flash and the bang were simultaneous. But you admit that the danger does exist - and aren't we increasing the risk, by the enormous speed at which we're travelling?'

Willis, of course, knew the answer perfectly well; once again he was putting himself in the place of his legions of unknown listeners on the planet that was getting a thousand kilometres further away with every passing second.

'It's hard to explain without mathematics,' said the Captain (how many times he had used that phrase. Even when it wasn't true!), 'but there's no simple relationship between speed and risk. To hit anything at spacecraft velocities would be catastrophic; if you're standing next to an atomic bomb when it goes off, it makes no difference whether it's in the kiloton or megaton class.'

That was not exactly a reassuring statement, but it was the best he could do. Before Willis could press the point further, he continued hastily:

'And let me remind you that any - er - slight extra risk we may be running is in the best of causes. A single hour may save lives.'

'Yes, I'm sure we all appreciate that.' Willis paused; he thought of adding 'And, of course, I'm in the same boat', but decided against it. It might sound immodest - not that modesty had ever been his strong suit. And anyway, he could hardly make a virtue of a necessity; he had very little alternative now, unless he decided to walk home.

'All this,' he continued, 'brings me to another point. Do you know what happened just a century and a half ago, on the North Atlantic?'

'In 1911?'

'Well, actually 1912 -'

Captain Smith guessed what was coming, and stubbornly refused to cooperate by pretending ignorance.

'I suppose you mean the Titanic,' he said.

'Precisely,' answered Willis, gamely concealing his disappointment. 'I've had at least twenty reminders from people who think they're the only one who's spotted the parallel.'

'What parallel? The Titanic was running unacceptable risks, merely trying to break a record.'

He almost added 'And she didn't have enough lifeboats', but luckily checked himself in time, when he recalled that the ship's one and only shuttle could carry not more than five passengers. If Willis took him up on that, it would involve altogether too many explanations.

'Well, I grant that the analogy is far-fetched. But there's another striking parallel which everyone points out. Do you happen to know the name of the Titanic's first and last Captain?'

'I haven't the faintest - ' began Captain Smith. Then his jaw dropped.

'Precisely,' said Victor Willis, with a smile which it would be charitable to call smug.

Captain Smith would willingly have strangled all those amateur researchers. But he could hardly blame his parents for bequeathing him the commonest of English names.

39
The Captain's Table

It was a pity that viewers on (and off) Earth could not have enjoyed the less formal discussions aboard Universe. Shipboard life had now settled down to a steady routine, punctuated by a few regular landmarks - of which the most important, and certainly the most long-established, was the traditional 'Captain's Table'.

At 18.00 hours exactly, the six passengers, and five of the officers not on duty, would join Captain Smith for dinner. There was, of course, none of the formal dress that had been mandatory aboard the floating palaces of the North Atlantic, but there was usually some attempt at sartorial novelty. Yva could always be relied upon to produce some new brooch, ring, necklace, hair-ribbon, or perfume from an apparently inexhaustible supply.

If the drive was on, the meal would begin with soup; but if the ship was coasting and weightless, there would be a selection of hors-d'oeuvres. In either event, before the main course was served Captain Smith would report the latest news - or try to dispel the latest rumours, usually fuelled by newscasts from Earth or Ganymede.

Accusations and countercharges were flying in all directions, and the most fantastic theories had been proposed to account for Galaxy's hijacking. A finger had been pointed at every secret organization known to exist, and many that were purely imaginary. All the theories, however, had one thing in common. Not one of them could suggest a plausible motive.

The mystery had been compounded by the one fact which had emerged. Strenuous detective work by ASTROPOL had established the surprising fact that the late 'Rose McCullen' was really Ruth Mason, born in North London, recruited to the Metropolitan Police - and then, after a promising start, dismissed for racist activities. She had emigrated to Africa - and vanished. Obviously, she had become involved in that unlucky continent's political underground. SHAKA was frequently mentioned, and as frequently denied by the USSA.

What all this could possibly have to do with Europa was endlessly, and fruitlessly, debated around the table - especially when Maggie M confessed that at one time she had been planning a novel about Shaka, from the viewpoint of one of his thousand unfortunate wives. But the more she researched the project, the more repellent it became. 'By the time I abandoned Shaka,' she wryly admitted, 'I knew exactly what a modern German feels about Hitler.'

Such personal revelations became more and more common as the voyage proceeded. When the main meal was over, one of the group would be given the floor for thirty minutes. Between them; they had a dozen lifetimes of experience, on as many heavenly bodies, so it would be hard to find a better source of after-dinner tales.

The least effective speaker was, somewhat surprisingly, Victor Willis. He was frank enough to admit it, and to give the reason.

'I'm so used,' he said, almost but not quite apologetically, 'to performing for an audience of millions that I find it hard to interact with a friendly little group like this.'

'Could you do better if it wasn't friendly?' asked Mihailovich, always anxious to be helpful. 'That could easily be arranged.'

Yva, on the other hand, turned out to be better than expected, even though her memories were confined entirely to the world of entertainment. She was particularly good on the famous - and infamous - directors she had worked with, especially David Griffin.

'Was it true,' asked Maggie M, doubtless thinking of Shaka, 'that he hated women?'

'Not at all,' Yva answered promptly. 'He just hated actors. He didn't believe they were human beings.'

Mihailovich's reminiscences also covered a somewhat limited territory - the great orchestras and ballet companies, famous conductors and composers, and their innumerable hangers-on. But he was so full of hilarious stories of backstage intrigues and liaisons, and accounts of sabotaged first nights and mortal feuds among prima donnas, that he kept even his most unmusical listeners convulsed with laughter, and was willingly granted extra time.

Colonel Greenburg's matter-of-fact accounts of extraordinary events could hardly have provided a greater contrast. The first landing at Mercury's - relatively - temperate south pole had been so thoroughly reported that there was little new to be said about it; the question that interested everyone was:

'When will we return?' That was usually followed by: 'Would you like to go back?'

'If they ask me to, of course I'll go,' Greenburg answered. 'But I rather think that Mercury is going to be like the Moon. Remember - we landed there in 1969 - and didn't go back again for half a lifetime. Anyway, Mercury isn't as useful as the Moon - though perhaps one day it may be. There's no water there; of course, it was quite a surprise to find any on the Moon. Or I should say in the Moon.

'Though it wasn't as glamorous as landing on Mercury, I did a more important job setting up the Aristarchus Mule-train.'

'Mule-train?'

'Yep. Before the big equatorial launcher was built, and they started shooting the ice straight into orbit, we had to haul it from the pit-head to the Imbrium Spaceport. That meant levelling a road across the lava plains and bridging quite a few crevasses. The Ice Road, we called it - only three hundred kilometres, but it took several lives to build...

'The "mules" were eight-wheeled tractors with huge tyres and independent suspension: they towed up to a dozen trailers, with a hundred tons of ice apiece. Used to travel by night - no need to shield the cargo then.

'I rode with them several times. The trip took about six hours - we weren't out to break speed records - then the ice would be offloaded into big, pressurized tanks, waiting for sunrise. As soon as it melted, it would be pumped into the ships.

'The Ice Road is still there, of course, but only the tourists use it now. If they're sensible, they'll drive by night, as we used to do. It was pure magic, with the full Earth almost directly overhead, so brilliant that we seldom used our own lights. And although we could talk to our friends whenever we wanted to, we often switched off the radio and left it to the automatics to tell them we were OK. We just wanted to be alone, in that great shining emptiness - while it was still there, because we knew it wouldn't last.

'Now they're building the Teravolt quarksmasher, running right around the equator, and domes are going up all over Imbrium and Serenitatis. But we knew the real lunar wilderness, exactly as Armstrong and Aldrin saw it - before you could buy "Wish you were here" cards in the post office at Tranquillity Base.'

40
Monsters from Earth

'... lucky you missed the Annual Ball: believe it or not, it was just as grisly as last year's. And once again our resident mastodon, dear Ms Wilkinson, managed to crush her partners' toes, even on the Half-gee Dance Floor.

'Now some business. Since you won't be back for months, instead of a couple of weeks, Admin is looking lustfully at your apartment - good neighbourhood, near downtown shopping area, splendid view of Earth on clear days, etc., etc. - and suggests a sublet until you return. Seems a good deal, and will save you a lot of money. We'll collect any personal effects you'd like stored.

'Now this Shaka business. We know you love pulling our legs, but frankly Jerry and I were horrified! I can see why Maggie M turned him down -yes, of course we've read her Olympic Lusts - very enjoyable, but too feminist for us.

'What a monster - I can understand why they've called a gang of African terrorists after him. Fancy executing his warriors if they got married! And killing all the poor cows in his wretched empire, just because they were female! Worst of all - those horrid spears he invented; shocking manners, jabbing them into people you've not been properly introduced to...

'And what a ghastly advertisement for us feys! Almost enough to make one want to switch. We've always claimed that we're gentle and kindhearted (as well as madly talented and artistic, of course) but now you've made us look into some of the so-called Great Warriors (as if there was anything great about killing people!) we're almost ashamed of the company we've been keeping.

'Yes, we did know about Hadrian and Alexander - but we certainly didn't know about Richard the Lion Heart and Saladin. Or Julius Caesar - though he was everything - ask Antony as well as Cleo. Or Frederick the Great, who does have some redeeming features; look how he treated old Bach.

'When I told Jerry that at least Napoleon is an exception - we don't have to be saddled with him - do you know what he said? "I bet Josephine was really a boy." Try that on Yva.

'You've ruined our morale, you rascal, tarring us with that blood-stained brush (sorry about the mixed metaphor). You should have left us in happy ignorance...

'Despite that, we send our love, and so does Sebastian. Say hello to any Europans you meet. Judging by the reports from Galaxy, some of them would make very good partners for Ms Wilkinson.'

41
Memoirs of a Centenarian

Dr Heywood Floyd preferred not to talk about the first mission to Jupiter, and the second to Lucifer ten years later. It was all so long ago - and there was nothing he had not said a hundred times to Congressional Committees, Space Council boards and media persons like Victor Willis.

Nevertheless, he had a duty to his fellow passengers which could not be avoided. As the only living man to have witnessed the birth of a new sun - and a new solar system - they expected him to have some special understanding of the worlds they were now so swiftly approaching. It was a naïve assumption; he could tell them far less about the Galilean satellites than the scientists and engineers who had been working there for more than a generation. When he was asked 'What's it really like on Europa?' (or Ganymede, or Io, or Callisto...) he was liable to refer the enquirer, rather brusquely, to the voluminous reports available in the ship's library.

Yet there was one area where his experience was unique. Half a century later, he sometimes wondered if it had really happened, or whether he had been asleep aboard Discovery when David Bowman had appeared to him. Almost easier to believe that a spaceship could be haunted...

But he could not have been dreaming, when the floating dust motes assembled themselves into that ghostly image of a man who should have been dead for a dozen years. Without the warning it had given him (how clearly he remembered that its lips were motionless, and the voice had come from the console speaker) Leonov and all aboard would have been vaporized in the detonation of Jupiter.

'Why did he do it?' Floyd asked during one of the after-dinner sessions. 'I've puzzled over that for fifty years. Whatever he became, after he went out in Discovery's space pod to investigate the monolith, he must still have had some links with the human race; he was not completely alien. We know that he returned to Earth - briefly - because of that orbiting bomb incident. And there's strong evidence that he visited both his mother and his old girlfriend; that's not the action of - of an entity that had discarded all emotions.'

'What do you suppose he is now?' asked Willis. 'For that matter - where is he?'

'Perhaps that last question has no meaning - even for human beings. Do you know where your consciousness resides?'

'I've no use for metaphysics. Somewhere in the general area of my brain, anyway.'

'When I was a young man,' sighed Mihailovich, who had a talent for deflating the most serious discussions, 'mine was about a metre lower down.'

'Let's assume he's on Europa; we know there's a monolith there, and Bowman was certainly associated with it in some way - see how he relayed that warning.'

'Do you think he also relayed the second one, telling us to stay away?'

'Which we are now going to ignore -'

' in a good cause -' Captain Smith, who was usually content to let the discussion go where it wished, made one of his rare interjections.

'Dr Floyd,' he said thoughtfully, 'you're in a unique position, and we should take advantage of it. Bowman went out of his way to help you once. If he's still around, he may be willing to do so again. I worry a good deal about that ATTEMPT NO LANDINGS HERE order. If he could assure us that it was - temporarily suspended, let's say - I'd be much happier.'

There were several 'hear, hear's around the table before Floyd answered.

'Yes, I've been thinking along the same lines. I've already told Galaxy to watch out for any - let's say manifestations - in case he tries to make contact.'

'Of course,' said Yva, 'he may be dead by now - if ghosts can die.'

Not even Mihailovich had a suitable comment to this, but Yva obviously sensed that no-one thought much of her contribution.

Undeterred, she tried again.

'Woody, dear,' she said. 'Why don't you simply give him a call on the radio? That's what it's for, isn't it?'

The idea had occurred to Floyd, but it had somehow seemed too naïve to take seriously.

'I will,' he said. 'I don't suppose it will do any harm.'

42
Minilith

This time, Floyd was quite sure he was dreaming...

He had never been able to sleep well in zero gravity, and Universe was now coasting, unpowered, at maximum velocity. In two days it would start almost a week of steady deceleration, throwing away its enormous excess speed until it was able to rendezvous with Europa.

However many times he adjusted the restraining straps, they always seemed either too tight or too loose. He would have difficulty in breathing - or else he would find himself drifting out of his bunk.

Once he had awoken in mid-air, and had flailed away for several minutes until, exhausted, he had managed to 'swim' the few metres to the nearest wall. Not until then had he remembered that he should merely have waited; the room ventilating system would have soon pulled him to the exhaust grille without any exertion on his part. As a seasoned space-traveller, he knew this perfectly well; his only excuse was simple panic.

But tonight, he had managed to get everything right; probably when weight returned, he would have difficulty in readjusting to that. He had lain awake for only a few minutes, recapitulating the latest discussion at dinner, and had then fallen asleep.

In his dreams, he had continued the conversation around the table. There had been a few trifling changes, which he accepted without surprise. Willis, for example, had grown his beard back - though on only one side of his face. This, Floyd presumed, was in aid of some research project, though he found it difficult to imagine its purpose.

In any event, he had his own worries. He was defending himself against the criticisms of Space Administrator Millson, who had somewhat surprisingly joined their little group. Floyd wondered how he had come aboard Universe (could he possibly have stowed away?). The fact that Millson had been dead for at least forty years seemed much less important.

'Heywood,' his old enemy was saying, 'the White House is most upset.'

'I can't imagine why.'

'That radio message you've just sent to Europa. Did it have State Department clearance?'

'I didn't think it was necessary. I merely asked permission to land.'

'Ah - but that's it. Who did you ask? Do we recognize the government concerned? I'm afraid it's all very irregular...

Millson faded away, still tut-tutting. I'm very glad this is only a dream, thought Floyd. Now what?

Well, I might have expected it. Hello, old friend. You come in all sizes, don't you? Of course, even TMA 1 couldn't have squeezed into my cabin - and its Big Brother could easily have swallowed Universe in one gulp.

The black monolith was standing - or floating - only two metres from his bunk. With an uncomfortable shock of recognition, Floyd realized that it was not only the same shape, but also the same size, as an ordinary tombstone. Although the resemblance had often been pointed out to him, until now the incongruity of scale had lessened the psychological impact. Now, for the first time, he felt the likeness was disquieting - even sinister. I know this is only a dream - but at my age, I don't want any reminders...

Anyway - what are you doing here? Do you bring a message from Dave Bowman? Are you Dave Bowman?

Well, I didn't really expect an answer; you weren't very talkative in the past, were you? But things always happened when you were around. Back in Tycho, sixty years ago, you sent that signal to Jupiter, to tell your makers that we'd dug you up. And look what you did to Jupiter, when we got there a dozen years later!

What are you up to now?

VI
HAVEN

43
Salvage

The first task confronting Captain Laplace and his crew, once they had grown accustomed to being on terra firma, was to re-orient themselves. Everything on Galaxy was the wrong way round.

Spaceships are designed for two modes of operation - either no gravity at all, or, when the engines are thrusting, an up-and-down direction along the axis. But now Galaxy was lying almost horizontally, and all the floors had become walls. It was exactly as if they were trying to live in a lighthouse that had toppled on to its side; every single piece of furniture had to be moved, and at least fifty per cent of the equipment was not functioning properly.

Yet in some ways this was a blessing in disguise, and Captain Laplace made the most of it. The crew was so busy rearranging Galaxy's interior - giving priority to the plumbing - that he had few worries about morale. As long as the hull remained airtight, and the muon generators continued to supply power, they were in no immediate danger; they merely had to survive for twenty days, and salvation would come from the skies in the shape of Universe. No-one ever mentioned the possibility that the unknown powers that ruled Europa might object to a second landing. They had - as far as anyone knew - ignored the first; surely they could not interfere with a mission of mercy...

Europa itself, however, was now less cooperative. While Galaxy had been adrift on the open sea, it had been virtually unaffected by the quakes which continually racked the little world. But now that the ship had become an all too permanent land structure, it was shaken every few hours by seismic disturbances. Had it touched down in the normal vertical position, by now it would certainly have been overturned.

The quakes were unpleasant rather than dangerous, but they gave nightmares to anyone who had experienced Tokyo '33 or Los Angeles '45. It did not help much to know that they followed a completely predictable pattern, rising to a peak of violence and frequency every three and a half days when Io came swinging past on its inner orbit. Nor was it much consolation to know that Europa's own gravitational tides were inflicting at least equal damage on Io.

After six days of gruelling work, Captain Laplace was satisfied that Galaxy was as near shipshape as was possible in the circumstances. He declared a holiday - which most of the crew spent sleeping - and then drew up a schedule for their second week on the satellite.

The scientists, of course, wanted to explore the new world they had so unexpectedly entered. According to the radar maps that Ganymede had transmitted to them, the island was fifteen kilometres long and five wide; its maximum elevation was only a hundred metres - not high enough, someone had gloomily predicted, to avoid a really bad tsunami.

It was hard to imagine a more dismal and forbidding place; half a century of exposure to Europa's feeble winds and rains had done nothing to break up the pillow lava which covered half its surface, or to soften the outcropping of granite that protruded through the rivers of frozen rock. But it was their home now, and they had to find a name for it.

Gloomy, downbeat suggestions like Hades, Inferno, Hell, Purgatory... were firmly vetoed by the Captain; he wanted something cheerful. One surprising and quixotic tribute to a brave enemy was seriously considered before being rejected thirty-two to ten, with five abstentions: the island would not be called 'Roseland'..

In the end, 'Haven' won unanimously.

44
Endurance

'History never repeats itself - but historical situations recur.'

As he made his daily report to Ganymede, Captain Laplace kept thinking of the phrase. It had been quoted by Margaret M'Bala - now approaching at almost a thousand kilometres every second - in a message of encouragement from Universe which he had been very happy to relay to his fellow castaways.

'Please tell Miss M'Bala that her little history lesson was extremely good for morale; she couldn't have thought of anything better to send us.

'Despite the inconvenience of having our walls and floors switched around, we're living in luxury compared to those old polar explorers. Some of us had heard of Ernest Shackleton, but we had no idea of the Endurance saga. To have been trapped on ice floes for over a year - then to spend the Antarctic winter in a cave - then to cross a thousand kilometres of sea in an open boat and to climb a range of unmapped mountains to reach the nearest human settlement!

'And yet that was only the beginning. What we find incredible - and inspiring - is that Shackleton went back four times to rescue his men on that little island - and saved every one of them! You can guess what that story's done to our spirits - I hope you can fax this book to us in your next transmission - we're all anxious to read it.

'And what would he have thought of that! Yes, we're infinitely better off than any of those old-time explorers. It's almost impossible to believe that, until well into the last century, they were completely cut off from the rest of the human race, once they'd gone over the horizon. We should be ashamed at grumbling because light isn't fast enough and we can't talk to our friends in real time - or that it takes a couple of hours to get replies from Earth... They had no contact for months - almost years! Again, Miss M'Bala - our sincerest thanks.

'Of course, all Earth explorers did have one considerable advantage over us; at least they could breathe the air. Our science team has been clamouring to go outside, and we've modified four spacesuits for EVAs of up to six hours. At this atmospheric pressure they won't need full suits - a waist seal is good enough -

and I'm allowing two men to go out at a time, as long as they stay within sight of the ship.

'Finally, here's today's weather report. Pressure two hundred and fifty bars, temperature steady at twenty-five degrees, wind gusting at up to thirty klicks from the west, usual hundred per cent overcast, quakes between one and three on open-ended Richter...

'You know, I never did like the sound of that "open-ended" - especially now that Io's coming into conjunction again.

45
Mission

When people asked to see him together, it usually meant trouble, or at least some difficult decision. Captain Laplace had noticed that Floyd and van der Berg were spending a lot of time in earnest discussions, often with Second Officer Chang, and it was easy to guess what they were talking about. Yet their proposal still took him by surprise.

'You want to go to Mount Zeus! How - in an open boat? Has that Shackleton book gone to your head?'

Floyd looked slightly embarrassed; the Captain was right on target. South had been an inspiration, in more ways than one.

'Even if we could build a boat, Sir, it would take much too long... especially now that Universe looks like reaching us within ten days.'

'And I'm not sure,' added van der Berg, 'that I'd care to sail on this "Sea of Galilee"; not all its inhabitants may have got the message that we're inedible.'

'So that leaves only one alternative, doesn't it? I'm sceptical, but I'm willing to be convinced. Go on...

'We've discussed it with Mr Chang, and he confirms that it can be done. Mount Zeus is only three hundred kilometres away; the shuttle can fly there in less than an hour.'

'And find a place to land? As you doubtless recall, Mr Chang wasn't very successful with Galaxy.'

'No problem, Sir, The William Tsung's only a hundredth of our mass; even that ice could probably have supported it. We've been over the video records, and found a dozen good landing sites.'

'Besides,' said van der Berg, 'the pilot won't have a pistol pointed at him. That could help.'

'I'm sure it will. But the big problem is at this end. How are you going to get the shuttle out of its garage? Can you rig a crane? Even in this gravity, it would be quite a load.'

'No need to, Sir. Mr Chang can fly it out.'

There was a prolonged silence while Captain Laplace contemplated, obviously without much enthusiasm, the idea of rocket motors firing inside his ship. The small shuttle William Tsung, more familiarly known as Bill Tee, was designed purely for orbital operations; normally, it would be pushed gently out of its 'garage', and the engines would not operate until it was well away from the mother ship.

'Obviously you've worked all this out,' said the Captain grudgingly, 'but what about the angle of take-off? Don't tell me you want to roll Galaxy over so that Bill Tee can pop straight up? The garage is half-way down one side; lucky it wasn't underneath when we grounded.'

'The take-off will have to be at sixty degrees to the horizontal; the lateral thrusters can handle it.'

'If Mr Chang says so, I'll certainly believe him. But what will the firing do to the ship?'

'Well, it will wreck the garage interior - but it will never be used again, anyway. And the bulkheads are designed for accidental explosions, so there's no danger of damage to the rest of the ship. We'll have fire-fighting crews standing by, just in case.'

It was a brilliant concept - no doubt of that. If it worked, the mission would not be a total failure. During the last week, Captain Laplace had given scarcely a moment's thought to the mystery of Mount Zeus, which had brought them to this predicament: only survival had mattered. But now there was hope, and leisure to think ahead. It would be worth taking some risks, to find why this little world was the focus of so much intrigue.

46
Shuttle

'Speaking from memory,' said Dr Anderson, 'Goddard's first rocket flew about fifty metres. I wonder if Mr Chang will beat that record?'

'He'd better - or we'll all be in trouble.'

Most of the science team had gathered in the observation lounge, and everyone was staring anxiously back along the hull of the ship. Although the entrance of the 'garage' was not visible from this angle, they would see the Bill Tee soon enough, when - and if - it emerged.

There was no countdown; Chang was taking his time, making every possible check - and would fire when he felt like it. The shuttle had been stripped down to its minimum mass, and was carrying just enough propellant for one hundred seconds of flight. If everything worked, that would be ample; if it didn't, more would not only be superfluous, but dangerous.

'Here we go,' said Chang casually.

It was almost like a conjuring trick; everything happened so quickly that the eye was deceived. No one saw Bill Tee pop out of the garage, because it was hidden in a cloud of steam. When the cloud had cleared, the shuttle was already landing, two hundred metres away.

A great cheer of relief echoed through the lounge.

'He did it!' cried ex-Acting Captain Lee. 'He's broken Goddard's record - easily!'

Standing on its four stubby legs in the bleak Europan landscape, Bill Tee looked like a larger and even less elegant version of an Apollo lunar module. That was not, however, the thought that occurred to Captain Laplace, as he looked out from the bridge. It seemed to him that his ship was rather like a stranded whale, that had managed a difficult birth in an alien element. He hoped that the new calf would survive.

Forty-eight very busy hours later, the William Tsung was loaded, checked out on a ten-kilometre circuit over the island - and ready to go. There was still plenty of time for the mission; by the most optimistic reckoning, Universe could not arrive for another three days, and the trip to Mount Zeus, even allowing for the deployment of Dr van der Berg's extensive array of instruments, would take only six hours.

As soon as Second Officer Chang had landed, Captain Laplace called him to his cabin. The Skipper looked, thought Chang, somewhat ill at ease.

'Good work, Walter - but of course that's only what we expect.'

'Thanks, Sir, So what's the problem?'

The Captain smiled. A well-integrated crew could keep no secrets.

'Head Office, as usual. I hate to disappoint you, but I've had orders that only Dr van der Berg and Second Officer Floyd are to make the trip.'

'I get the picture,' Chang answered, with a trace of bitterness. 'What have you told them?'

'Nothing, yet; that's why I wanted to talk to you. I'm quite prepared to say that you're the only pilot who can fly the mission.'

'They'll know that's nonsense; Floyd could do the job as well as I could. There's not the slightest risk - except for a malfunction, which could happen to anyone.'

'I'd still be willing to stick my neck out, if you insist. After all, no-one can stop me - and we'll all be heroes when we get back to Earth.'

Chang was obviously doing some intricate calculations. He seemed rather pleased with the result.

'Replacing a couple of hundred kilos of payload with propellant gives us an interesting new option; I'd intended to mention it earlier, but there was no way Bill Tee could manage with all that extra gear and a full crew...'

'Don't tell me. The Great Wall.'

'Of course; we could do a complete survey in one or two passes, and find what it really is.'

'I thought we had a very good idea, and I'm not sure if we should go near it. That might be pressing our luck.'

'Perhaps. But there's another reason; to some of us, it's an even better one...'

'Go on.'

'Tsien. It's only ten kilometres from the Wall. We'd like to drop a wreath there.'

So that was what his officers had been discussing so solemnly; not for the first time, Captain Laplace wished he knew a little more Mandarin.

'I understand,' he said quietly. 'I'll have to think it over - and talk to van der Berg and Floyd to see if they agree.'

'And Head Office?'

'No, dammit. This will be my decision.'

47
Shards

'You'd better hurry,' Ganymede Central had advised, 'The next conjunction will be a bad one - we'll be triggering quakes as well as Io. And we don't want to scare you - but unless our radar's gone crazy, your mountain's sunk another hundred metres since the last check.'

At that rate, thought van der Berg, Europa will be flat again in ten years. How much faster things happened here than on Earth; which was one reason why the place was so popular with geologists.

Now that he was strapped into the number two position immediately behind Floyd, and virtually surrounded by consoles of his own equipment, he felt a curious mixture of excitement and regret. In a few hours, the great intellectual adventure of his life would be over - one way or the other. Nothing that would ever happen again could possibly match it.

He did not have the slightest trace of fear; his confidence in both man and machine was complete. One unexpected emotion was a wry sense of gratitude to the late Rose McCullen; without her, he would never have had this opportunity, but might have gone, still uncertain, to his grave.

The heavily laden Bill Tee could barely manage one-tenth of a gravity at lift-off; it was not intended for this sort of work, but would manage much better on the homeward journey when it had deposited its cargo. It seemed to take ages to climb clear of Galaxy, and they had ample time to note the damage to the hull as well as signs of corrosion from the occasional mildly acid rains. While Floyd concentrated on the lift-off, van der Berg gave a quick report on the ship's condition from the viewpoint of a privileged observer. It seemed the right thing to do - even though, with any luck, Galaxy's space-worthiness would soon be of no further concern to anyone.

Now they could see the whole of Haven spread out beneath them, and van der Berg realized what a brilliant job Acting Captain Lee had done when he beached the ship. There were only a few places where it could have been safely grounded; although a good deal of luck had also been involved, Lee had used wind and sea-anchor to the best possible advantage.

The mists closed around them; Bill Tee was rising on a semi-ballistic trajectory to minimize drag, and there would be nothing to see except the clouds for twenty minutes. A pity, thought van der Berg; I'm sure there must be some interesting creatures swimming around down there, and no-one else may have a chance of seeing them.

'Coming up to engine cut-off,' said Floyd. 'Everything normal.'

'Very good, Bill Tee. No report of traffic at your altitude. You're still number one on the runway to land.'

'Who's that joker?' asked van der Berg.

'Ronnie Lim. Believe it or not, that "number one on the runway" goes back to Apollo.'

Van der Berg could understand why. There was nothing like the occasional touch of humour - providing it was not overdone - to relieve the strain when men were involved in some complex and possibly hazardous enterprise.

'Fifteen minutes before we start braking,' said Floyd. 'Let's see who else is on the air.'

He started the autoscan, and a succession of beeps and whistles, separated by short silences as the tuner rejected them one by one in its swift climb up the radio spectrum, echoed round the little cabin.

'Your local beacons and data transmissions,' said Floyd. 'I was hoping - ah, here we are!'

It was only a faint musical tone, warbling rapidly up and down like a demented soprano. Floyd glanced at the frequency meter.

'Doppler shift almost gone - she's slowing fast.'

'What is it -text?'

'Slowscan video, I think. They're relaying a lot of material back to Earth through the big dish on Ganymede, when it's in the right position. The networks are yelling for news.'

They listened to the hypnotic but meaningless sound for a few minutes; then Floyd switched it off. Incomprehensible though the transmission from Universe was to their unaided senses, it conveyed the only message that mattered. Help was on the way, and would soon be there.

Partly to fill the silence, but also because he was genuinely interested, van der Berg remarked casually: 'Have you talked to your grandfather lately?'

'Talked', of course, was a misnomer where interplanetary distances were concerned, but no-one had come up with an acceptable alternative. 'Voicegram', 'audiomail' and 'vocard' had all flourished briefly, then vanished into limbo. Even now, most of the human race probably did not believe that realtime conversation was impossible in the Solar System's wide, open spaces, and from time to time indignant protests were heard: 'Why can't you scientists do something about it?'

'Yes,' said Floyd. 'He's in fine shape, and I look forward to meeting him.'

There was a slight strain in his voice. I wonder, thought van der Berg, when they last met; but he realized that it would be tactless to ask. Instead, he spent the next ten minutes rehearsing the off-loading and setting-up procedures with Floyd, so there would be no unnecessary confusion when they touched down.

The COMMENCE BRAKING alarm went off just a fraction of a second after Floyd had already started the program sequencer. I'm in good hands, thought van der Berg: I can relax and concentrate on my job. Where's that camera - don't say it's floated away again.

The clouds were clearing. Even though the radar had shown exactly what was beneath them, in a display as good as normal vision could provide, it was still a shock to see the face of the mountain rearing up only a few kilometres ahead.

'Look!' cried Floyd suddenly. 'Over to the left -by that double peak - give you one guess!'

'I'm sure you're right - I don't think we did any damage - it just splattered - wonder where the other one hit-'

'Altitude one thousand. Which landing site? Alpha doesn't look so good from here.'

'You're right - try Gamma - closer to the mountain, anyway.'

'Five hundred. Gamma it is. I'll hover for twenty secs - if you don't like it, we'll switch to Beta. Four hundred... Three hundred... Two hundred. ('Good luck, Bill Tee,' said Galaxy briefly). Thanks, Ronnie... One hundred and fifty... One hundred... Fifty... How about it? Just a few small rocks, and - that's peculiar - what looks like broken glass all over the place - someone's had a wild party here... Fifty... Fifty... Still OK?'

'Perfect. Go down.'

'Forty... thirty... twenty... Sure you don't want to change your mind?... Ten... Kicking up a little dust, as Neil said once - or was it Buzz?... Five... Contact! Easy, wasn't it? Don't know why they bother to pay me.'

48
Lucy

'Hello, Gany Central - we've made a perfect landing - I mean Chris has - on a flat surface of some metamorphic rock - probably the same pseudogranite we've called Havenite. The base of the mountain is only two kilometres away, but already I can tell there's no real need to go any closer.

'We're putting on our top-suits now, and will start unloading in five minutes. Will leave the monitors running, of course, and will call on every quarter-hour. Van out.'

'What did you mean by that "no need to go any closer"?' asked Floyd.

Van der Berg grinned. In the last few minutes he seemed to have shed years, and almost to have become a carefree boy.

'Circumspice,' he said happily. 'Latin for "look around you". Let's get the big camera out first - wow!'

The Bill Tee gave a sudden lurch, and for a moment heaved up and down on its landing-gear shock absorbers with a motion that, if it had continued for more than a few seconds, would have been a recipe for instant sea sickness.

'Ganymede was right about those quakes,' said Floyd, when they had recovered. 'Is there any serious danger?'

'Probably not; it's still thirty hours to conjunction, and this looks a solid slab of rock. But we won't waste any time here - luckily we won't need to. Is my mask straight? It doesn't feel right.'

'Let me tighten the strap. That's better. Breathe in hard - good, now it fits fine. I'll go first.'

Van der Berg wished that his could be the first small step, but Floyd was the commander and it was his duty to check that the Bill Tee was in good shape - and ready for an immediate take-off.

He walked once around the little spacecraft, examining the landing gear, then gave the thumbs-up signal to van der Berg, who started down the ladder to join him. Although he had worn the same lightweight breathing equipment on his exploration of Haven, he felt a little awkward with it, and paused at the landing pad to make some adjustments. Then he glanced up - and saw what Floyd was doing.

'Don't touch it!' he cried. 'It's dangerous!'

Floyd jumped a good metre away from the shards of vitreous rock he was examining. To his untrained eye, they looked rather like an unsuccessful melt from a large glass furnace.

'It's not radioactive, is it?' he asked anxiously. 'No. But stay away until I've got there.'

To his surprise, Floyd realized that van der Berg was wearing heavy gloves. As a space officer, it had taken him a long time to grow accustomed to the fact that, here on Europa, it was safe to expose one's bare skin to the atmosphere. Nowhere else in the Solar System - even on Mars - was that possible.

Very cautiously, van der Berg reached down and picked up a long splinter of the glassy material. Even in this diffused light, it glittered strangely, and Floyd could see that it had a vicious edge.

'The sharpest knife in the known universe,' said van der Berg happily.

'We've been through all this to find a knife!'

Van der Berg started to laugh, then found it wasn't easy inside his mask.

'So you still don't know what this is about?'

'I'm beginning to feel I'm the only one who doesn't.'

Van der Berg took his companion by the shoulder, and turned him to face the looming mass of Mount Zeus. From this distance, it filled half the sky - not merely the greatest, but the only mountain on this whole world.

'Admire the view just for one minute. I have an important call to make.'

He punched a code sequence on his comset, waited for the READY light to flash, and said: 'Ganymede Central 109 - this is Van. Do you receive?'

After no more than the minimum timelag, an obviously electronic voice answered:

'Hello, Van. This is Ganymede Central 109. Ready to receive.'

Van der Berg paused, savouring the moment he would remember for the rest of his life.

'Contact Earth Ident Uncle 737. Relay following message. LUCY IS HERE. LUCY IS HERE. End message. Please repeat.'

Perhaps I should have stopped him saying that, whatever it means, thought Floyd, as Ganymede repeated the message. But it's too late now. It will reach Earth within the hour.

'Sorry about that, Chris,' grinned van der Berg. 'I wanted to establish priority - amongst other things.'

'Unless you start talking soon, I'll begin carving you up with one of these patent glass knives.'

'Glass, indeed! Well, the explanation can wait - it's absolutely fascinating, but quite complicated. So I'll give you the straight facts.

'Mount Zeus is a single diamond, approximate mass one million million tons. Or, if you prefer it that way, about two times ten to the seventeenth carats. But I can't guarantee that it's all gem quality.'

VII
THE GREAT WALL

49
Shrine

As they unloaded the equipment from Bill Tee and set it up on their little granite landing-pad, Chris Floyd found it hard to tear his eyes away from the mountain looming above them. A single diamond - bigger than Everest! Why, the scattered fragments lying round the shuttle must be worth billions, rather than millions.

On the other hand, they might be worth no more than - well, scraps of broken glass. The value of diamonds had always been controlled by the dealers and producers, but if a literal gem-mountain came suddenly on the market, prices would obviously collapse completely. Now Floyd began to understand why so many interested parties had focused their attention upon Europa; the political and economic ramifications were endless.

Now that he had at last proved his theory, van der Berg had become again the dedicated and single-minded scientist, anxious to complete his experiment with no further distraction. With Floyd's help - it was not easy to get some of the bulkier pieces of equipment out of Bill Tee's cramped cabin - they first drilled a metre-long core with a portable electric drill, and carried it carefully back to the shuttle.

Floyd would have had a different set of priorities, but he recognized that it made sense to do the harder tasks first. Not until they had laid out a seismograph array and erected a panoramic TV camera on a low, heavy tripod did van der Berg condescend to collect some of the incomputable riches lying all around them.

'At the very least,' he said, as he carefully selected some of the less lethal fragments, 'they'll make good souvenirs.'

'Unless Rosie's friends murder us to get them.'

Van der Berg looked sharply at his companion; he wondered how much Chris really knew - and how much, like all of them, he was guessing.

'Not worth their while, now that the secret's out. In about an hour's time, the Stock Exchange computers will be going crazy.'

'You bastard!' said Floyd, with admiration rather than rancour. 'So that's what your messsage was about.'

'There's no law that says a scientist shouldn't make a little profit on the side - but I'm leaving the sordid details to my friends on Earth. Honestly, I'm much more interested in the job we're doing here. Let me have that wrench, please...'

Three times before they had finished establishing Zeus Station they were almost knocked off their feet by quakes. They could feel them first as a vibration underfoot, then everything would start shaking - then there would be a horrible, long-drawn-out groaning sound that seemed to come from every direction. It was even air-borne, which to Floyd seemed strangest of all. He could not quite get used to the fact that there was enough atmosphere around them to allow short-range conversations without radio.

Van der Berg kept assuring him that the quakes were still quite harmless, but Floyd had learned never to put too much trust in experts. True, the geologist had just been proved spectacularly right; as he looked at Bill Tee heaving on its shock-absorbers like a storm-tossed ship, he hoped that Van's luck would hold for at least a few more minutes.

'That seems to be it,' said the scientist at last, to Floyd's great relief. 'Ganymede's getting good data on all channels. The batteries will last for years, with the solar panel to keep recharging them.'

'If this gear is still standing a week from now, I'll be very surprised. I'll swear that mountain's moved since we landed - let's get off before it falls on top of us.'

'I'm more worried,' laughed van der Berg, 'that your jet-blast will undo all our work.'

'No risk of that - we're well clear, and now we've offloaded so much junk we'll need only half-power to lift. Unless you want to take aboard a few more billions. Or trillions.'

'Let's not be greedy. Anyway, I can't even guess what this will be worth when we get it to Earth. The museums will grab most of it, of course. After that - who knows?'

Floyd's fingers were flying over the control panel as he exchanged messages with Galaxy.

'First stage of mission completed. Bill Tee ready for take-off. Flight plan as agreed.'

They were not surprised when Captain Laplace answered.

'You're quite certain you want to go ahead? Remember, you have the final decision. I'll back you up, whatever it is.'

'Yessir, we're both happy. We understand how the crew feels. And the scientific payoff could be enormous - we're both very excited.'

'Just a minute - we're still waiting for your report on Mount Zeus!'

Floyd looked at van der Berg, who shrugged his shoulders and then took the microphone.

'If we told you now, Captain, you'd think we were crazy - or pulling your leg. Please wait a couple of hours until we're back - with the evidence.'

'Hm. Not much point giving you an order, is it? Anyway - good luck. And from the owner as well - he thinks going to Tsien is a splendid idea.'

'I knew Sir Lawrence would approve,' Floyd remarked to his companion. 'And anyway - with Galaxy already a total loss, Bill Tee's not much extra risk, is it?'

Van der Berg could see his point of view, even though he did not entirely subscribe to it. He had made his scientific reputation; but he still looked forward to enjoying it.

'Oh - by the way,' Floyd said. 'Who was Lucy - anybody in particular?'

'Not as far as I know. We came across her in a computer search, and decided the name would make a good code word - everyone would assume it was something to do with Lucifer, which is just enough of a half-truth to be beautifully misleading....

'I'd never heard of them, but a hundred years ago there was a group of popular musicians with a very strange name - the Beatles - spelled B-E-A-T-L-E-S, don't ask me why. And they wrote a song with an equally strange title: "Lucy in the Sky with Diamonds". Weird, isn't it? Almost as if they knew...'

According to Ganymede radar, the wreck of the Tsien lay three hundred kilometres west of Mount Zeus, towards the twilight zone and the cold lands beyond. Permanently cold they were, but not dark; half the time they were brilliantly lit by the distant Sun. However, even by the end of the long Europan solar day, the temperature was still far below freezing point. As liquid water could exist only on the hemisphere facing Lucifer, the intermediate region was a place of continual storms, where rain and hail, sleet and snow contended for supremacy.

During the half-century since Tsien's disastrous landing, the ship had moved almost a thousand kilometres. It must have drifted - like Galaxy - for several years on the newly created Sea of Galilee, before coming to rest on its bleakly inhospitable shore.

Floyd picked up the radar echo as soon as Bill Tee flattened out at the end of its second leap across Europa. The signal was surprisingly weak for so large an object; as soon as they broke through the clouds, they realized why.

The wreck of the spaceship Tsien, first man-carrying vessel to land on a satellite of Jupiter, stood in the centre of a small, circular lake - obviously artificial, and connected by a canal to the sea, less than three kilometres away. Only the skeleton was left, and not even all of that; the carcass had been picked clean.

But by what? van der Berg asked. There was no sign of life there; the place looked as if it had been deserted for years. Yet he had not the slightest doubt that something had stripped the wreck, with deliberate and indeed almost surgical precision.

'Obviously safe to land,' said Floyd, waiting for a few seconds to get van der Berg's almost absentminded nod of approval. The geologist was already videoing everything in sight.

Bill Tee settled down effortlessly by the side of the pool, and they looked across the cold, dark water at this monument to man's exploring impulses. There seemed no convenient way of getting to the wreck, but that did not really matter.

When they had suited up, they carried the wreath to the water's edge, held it solemnly for a moment in front of the camera, then tossed in this tribute from Galaxy's crew. It had been beautifully made; even though the only raw materials available were metal foil, paper and plastic, one could easily believe that the flowers and leaves were real. Pinned all over them were notes and inscriptions, many written in the ancient but now officially obsolete script rather than Roman characters.

As they were walking back to the Bill Tee, Floyd said thoughtfully: 'Did you notice - there was practically no metal left. Only glass, plastic, synthetics.'

'What about those ribs and supporting girders?'

'Composite - mostly carbon, boron. Someone round here is very hungry for metal - and knows it when it sees it. Interesting...'

Very, thought van der Berg. On a world where fire could not exist, metals and alloys would be almost impossible to make, and as precious as - well, diamonds.

When he had reported to base, and received a message of gratitude from Second Officer Chang and his colleagues, Floyd took the Bill Tee up to a thousand metres and continued westward.

'Last lap,' he said, 'no point in going higher - we'll be there in ten minutes. But I won't land; if the Great Wall is what we think it is, I'd prefer not to. We'll do a quick flyby and head for home. Get those cameras ready; this could be even more important than Mount Zeus.'

And, he added to himself, I may soon know what Grandfather Heywood felt, not so far from here, fifty years ago. We'll have a lot to talk about when we meet - less than a week from now, if all goes well.

50
Open City

What a terrible place, thought Chris Floyd - nothing but driving sleet, flurries of snow, occasional glimpses of landscapes streaked with ice - why, Haven was a tropical paradise by comparison! Yet he knew that the nightside, only a few hundred kilometres further on round the curve of Europa, was even worse.

To his surprise, the weather cleared suddenly and completely just before they reached their goal. The clouds lifted - and there ahead was an immense, black wall, almost a kilometre high, lying directly across Bill Tee's flight path. It was so huge that it was obviously creating its own microclimate; the prevailing winds were being deflected around it, leaving a local, calm area in its lee.

It was instantly recognizable as the Monolith, and sheltering at its foot were hundreds of hemispherical structures, gleaming a ghostly white in the rays of the low-hanging sun that had once been Jupiter. They looked, thought Floyd, exactly like old-style beehives made of snow; something in their appearance evoked other memories of Earth. Van der Berg was one jump ahead of him.

'Igloos,' he said. 'Same problem - same solution. No other building material around here, except rock - which would be much harder to work. And the low gravity must help - some of those domes are quite large. I wonder what lives in them...'

They were still too far away to see anything moving in the streets of this little city at the edge of the world. And as they came closer, they saw that there were no streets.

'It's Venice, made of ice,' said Floyd. 'All igloos and canals.'

'Amphibians,' answered van der Berg. 'We should have expected it. I wonder where they are?'

'We may have scared them. Bill Tee's much noisier outside than in.'

For a moment, van der Berg was too busy filming and reporting to Galaxy to reply. Then he said: 'We can't possibly leave without making some contact. You're right - this is far bigger than Mount Zeus.'

'And it could be more dangerous.'

'I don't see any sign of advanced technology - correction, that looks like an old twentieth-century radar dish over there! Can you get closer?'

'And get shot at? No thanks. Besides, we're using up our hover time. Only another ten minutes - if you want to get home again.'

'Can we at least land and look around? There's a patch of clear rock over there. Where the hell is everybody?'

'Scared, like me. Nine minutes. I'll do one trip across town - film everything you can - yes, Galaxy - we're OK - just rather busy at the moment - call you later -'

'I've just realized - that's not a radar dish, but something almost as interesting. It's pointing straight at Lucifer - it's a solar furnace! Makes a lot of sense in a place where the sun never moves - and you can't light a fire.'

'Eight minutes. Too bad everyone's hiding indoors.'

'Or back in the water. Can we look at that big building with the open space around it? I think it's the town hall.'

Van der Berg was pointing towards a structure much larger than all the others, and of quite different design; it was a collection of vertical cylinders, like oversized organ-pipes. Moreover, it was not the featureless white of the igloos, but showed a complex mottling over its entire surface.

'Europan art!' cried van der Berg. 'That's a mural of some kind! Closer, closer! We must get a record!'

Obediently, Floyd dropped lower - and lower - and lower. He seemed to have completely forgotten all his earlier reservations about hover time; and suddenly, with shocked incredulity, van der Berg realized that he was going to land.

The scientist tore his eyes from the rapidly approaching ground, and glanced at his pilot. Though he was obviously still in full control of Bill Tee, Floyd seemed to be hypnotized; he was staring at a fixed point straight ahead of the descending shuttle.

'What's the matter, Chris?' van der Berg cried. 'Do you know what you're doing?'

'Of course. Can't you see him?'

'See who?'

'That man, standing by the biggest cylinder. And he's not wearing any breathing gear!'

'Don't be an idiot, Chris: there's no one there.'

'He's looking up at us. He's waving - I think I recog - Oh my God!'

'There's no-one - no-one! Pull up!'

Floyd ignored him completely. He was absolutely calm and professional as he brought Bill Tee in to a perfect landing, and cut the motor at exactly the right instant before touchdown.

Very thoroughly, he checked the instrument readings, and set the safety switches. Only when he had completed the landing sequence did he again look out of the observation window, with a puzzled but happy expression on his face.

'Hello, Grandfather,' he said softly, to no-one at all that van der Berg could see.

51
Phantom

Even in his most horrible nightmares, Dr van der Berg had never imagined being stranded on a hostile world in a tiny space capsule, with only a madman for company. But at least Chris Floyd did not seem to be violent; perhaps he could be humoured into taking off again and flying them safely back to Galaxy...

He was still staring at nothing, and from time to time his lips moved in silent conversation. The alien 'town' remained completely deserted, and one could almost imagine that it had been abandoned for centuries. Presently, however, van der Berg noticed some tell-tale signs of recent occupancy. Although Bill Tee's rockets had blasted away the thin layer of snow immediately around

them, the remainder of the little square was still lightly powdered. It was a page torn from a book, covered with signs and hieroglyphics, some of which he could read.

A heavy object had been dragged in that direction - or had made its way clumsily under its own power. Leading from the now closed entrance of one igloo was the unmistakable track of a wheeled vehicle. Too far away to make out details was a small object that could have been a discarded container; perhaps Europans were sometimes as careless as humans...

The presence of life was unmistakable, overwhelming. Van der Berg felt he was being watched by a thousand eyes - or other senses - and there was no way of guessing whether the minds behind them were friendly, or hostile. They might even be indifferent, merely waiting for the intruders to go away, so that they could continue their interrupted and mysterious business.

Then Chris Floyd spoke once again into the empty air.

'Goodbye, Grandfather,' he said quietly, with just a trace of sadness. Turning towards van der Berg he added in a normal conversational tone: 'He says it's time to leave. I guess you must think I'm crazy.'

It was wisest, decided van der Berg, not to agree. In any event, he soon had something else to worry about.

Floyd was now staring anxiously at the read-outs that Bill Tee's computer was feeding to him. Presently he said, in an understandable tone of apology:

'Sorry about this, Van. That landing used up more fuel than I'd intended. We'll have to change the mission profile.'

That, van der Berg thought bleakly, was a rather roundabout way of saying: 'We can't get back to Galaxy.' With difficulty, he. managed to suppress a 'Damn your grandfather!' and merely asked: 'So what do we do?'

Floyd was studying the chart, and punching in more numbers.

'We can't stay here -, (Why not? thought van der Berg. If we're going to die anyway, we might use our time learning as much as possible.) ' - so we should find a place where the shuttle from Universe can pick us up easily.'

Van der Berg breathed a huge mental sigh of relief. Stupid of him not to have thought of that; he felt like a man who had been reprieved just when he was being taken to the gallows. Universe should reach Europa in less than four days; Bill Tee's accommodation could hardly be called luxurious, but it was infinitely preferable to most of the alternatives he could imagine.

'Away from this filthy weather - a stable, flat surface - closer to Galaxy, though I'm not sure if that helps much - shouldn't be any problem. We've enough for five hundred kilometres - it's just that we can't risk the sea crossing.'

For a moment, van der Berg thought wistfully of Mount Zeus; there was so much that could be done there. But the seismic disturbances - steadily getting worse as lo came into line with Lucifer - ruled that out completely. He wondered if his instruments were still working, and would check them again as soon as they'd dealt with the immediate problem.

'I'll fly down the coast to the equator - best place to be anyway for a shuttle landing - the radar map showed some smooth areas just inland round sixty west.'

'I know. The Masada Plateau.' (And, van der Berg added to himself, perhaps a chance for a little more exploring. Never miss an unexpected opportunity...)

'The Plateau it is. Goodbye, Venice. Goodbye, Grandfather...'

* * *

When the muted roar of the braking rockets had died away, Chris Floyd safetied the firing circuits for the last time, released his seat belt, and stretched arms and legs as far as he could in Bill Tee's confined quarters.

'Not such a bad view - for Europa,' he said cheerfully. 'Now we've four days to find out if shuttle rations are as bad as they claim. So - which of us starts talking first?'

52
On the Couch

I wish I'd studied some psychology, thought van der Berg; then I could explore the parameters of his delusion. Yet now he seems completely sane - except on that one subject.

Though almost any seat was comfortable at one-sixth of a gravity, Floyd had tilted his to the fully reclining position and had clasped his hands behind his head. Van der Berg suddenly recalled that this was the classic position of a patient, in the days of the old and still not entirely discredited Freudian analysis.

He was glad to let the other talk first, partly out of sheer curiosity but chiefly because he hoped that the sooner Floyd got this nonsense out of his system, the sooner he would be cured - or, at least, harmless. But he did not feel too optimistic: there must have been some serious, deep-seated problem in the first place to trigger so powerful an illusion.

It was very disconcerting to find that Floyd agreed with him completely, and had already made his own diagnosis.

'My crew psych rating is Al plus,' he said, 'which means that they'll even let me look at my own files - only about ten per cent can do this. So I'm as baffled as you are - but I saw Grandfather, and he spoke to me. I've never believed in ghosts - who does? - but this must mean that he's dead. I wish I could have got to know him better - I'd been looking forward to our meeting... Still, now I have something to remember...'

Presently van der Berg asked: 'Tell me exactly what he said.'

Chris smiled a little wanly and answered: 'I've never had one of those total recall memories, and I was so stunned by the whole thing that I can't give you many of the actual words.' He paused, and a look of concentration appeared on his face.

'That's strange; now I look back, I don't think we did use words.'

Even worse, thought van der Berg; telepathy as well as survival after death. But he merely said:

'Well, give me the general gist of the - er -conversation. I never heard you say anything remember.'

'Right. He said something like, "I wanted to see you again, and I'm very happy. I'm sure everything is going to work out well, and Universe will soon pick you up."

Typical bland spirit message, thought van der Berg. They never say anything useful or surprising - merely reflect the hopes and fears of the listener. Zero-information echoes from the subconscious.

'Go on.'

'Then I asked him where everyone was - why the place was deserted. He laughed and gave me an answer I still don't understand. Something like: "I know you didn't intend any harm - when we saw you coming, we barely had time to give the warning. All the - " and here he used a word I couldn't pronounce even if I could remember it - "got into the water - they can move quite quickly when they have to! They won't come out until you've left, and the wind has blown the poison away." What could he have meant by that? Our exhaust is nice, clean steam - and that's what most of their atmosphere is, anyway.'

Well, thought van der Berg, I suppose there's no law that says a delusion - any more than a dream - has to make logical sense. Perhaps the concept of 'poison' symbolizes some deep-rooted fear that Chris, despite his excellent psych rating, is unable to face. Whatever it is, I doubt if it's any concern of mine. Poison, indeed! Bill Tee's propellant mass is pure, distilled water shipped up to orbit from Ganymede.

But wait a minute. How hot is it when it comes out of the exhaust? Haven't I read somewhere... ?

'Chris,' said van der Berg cautiously, 'after the water's gone through the reactor, does it all come out as steam?'

'What else could it do? Oh, if we run really hot, ten or fifteen per cent gets cracked to hydrogen and oxygen.'

Oxygen! Van der Berg felt a sudden chill, even though the shuttle was at comfortable room temperature. It was most unlikely that Floyd understood the implications of what he had just said; the knowledge was outside his normal sphere of expertise.

'Did you know, Chris, that to primitive organisms on Earth, and certainly to creatures living in an atmosphere like Europa's, oxygen is a deadly poison?'

'You're joking.'

'I'm not: it's even poisonous to us, at high pressure.'

'I did know that; we were taught it in our diving course.'

'Your - grandfather - was talking sense. It's as if we'd sprayed that city with mustard gas. Well, not quite as bad as that - it would disperse very quickly.'

'So now you believe me.'

'I never said I didn't.'

'You would have been crazy if you did!'

That broke the tension, and they had a good laugh together.

'You never told me what he was wearing.'

'An old-fashioned dressing gown, just as I remembered when I was a boy. Looked very comfortable.'

'Any other details?'

'Now you mention it, he looked much younger, and had more hair than when I saw him last. So I don't think he was - what can I say? - real. Something like a computer-generated image. Or a synthetic hologram.'

'The Monolith!'

'Yes - that's what I thought. You remember how Dave Bowman appeared to Grandfather on Discovery? Perhaps it's his turn now. But why? He didn't give me any warning - not even any particular message. Just wanted to say goodbye and wish me well...'

For a few embarrassing moments Floyd's face began to crumple; then he regained control, and smiled at van der Berg.

'I've done enough talking. Now it's your turn to explain just what a million-million-ton diamond is doing - on a world made mostly of ice and sulphur. It had better be good.'

'It is,' said Dr Rolf van der Berg.

53
Pressure Cooker

'When I was studying at Flagstaff,' began van der Berg, 'I came across an old astronomy book that said: "The Solar System consists of the Sun, Jupiter - and assorted debris." Puts Earth in its place, doesn't it? And hardly fair to Saturn, Uranus and Neptune - the other three gas giants come to almost half as much as Jupiter.

'But I'd better start with Europa. As you know, it was flat ice before Lucifer started warming it up - greatest elevation only a couple of hundred metres - and it wasn't much different after the ice had melted and a lot of the water had migrated and frozen out on Farside. From 2015 - when our detailed observations began - until '38, there was only one high point on the whole moon - and we know what that was.'

'We certainly do. But even though I've seen it with my own eyes, I still can't picture the Monolith as a wall! I always visualize it as standing upright - or floating freely in space.'

'I think we've learned that it can do anything it wants to - anything we can imagine - and a lot more.

'Well, something happened to Europa in '37, between one observation and the next. Mount Zeus - all of ten kilometres high! - suddenly appeared.

'Volcanoes that big don't pop up in a couple of weeks; besides, Europa's nothing like as active as Io.'

'It's active enough for me,' Floyd grumbled. 'Did you feel that one?'

'Besides, if it had been a volcano, it would have spewed enormous amounts of gas into the atmosphere; there were some changes, but nothing like enough to account for that explanation. It was all a complete mystery, and because we were scared of getting too close - and were busy on our own projects - we didn't do much except spin fantastic theories. None of them, as it turned out, as fantastic as the truth.

'I first suspected it from some chance observations in '57, but didn't really take them seriously for a couple of years. Then the evidence became stronger; for anything less bizarre, it would have been completely convincing.

'But before I could believe that Mount Zeus was made of diamond, I had to find an explanation. To a good scientist - and I think I'm a good one - no fact is really respectable until there's a theory to account for it. The theory may turn out to be wrong - it usually is, in some details at least - but it must provide a working hypothesis.

'And as you pointed out, a million-million-ton diamond on a world of ice and sulphur takes a little explaining. Of course, now it's perfectly obvious and I feel a damn fool not to have seen the answer years ago. Might have saved a lot of trouble - and at least one life - if I had.'

He paused thoughtfully, then suddenly asked Floyd:

'Anyone mention Dr Paul Kreuger to you?'

'No. Why should they? I've heard of him, of course.

'I just wondered. A lot of strange things have been going on, and I doubt if we'll ever know all the answers.

'Anyway, it's no secret now, so it doesn't matter. Two years ago I sent a confidential message to Paul - oh, sorry, I should have mentioned - he's my uncle - with a summary of my findings. I asked if he could explain them - or refute them.

'Didn't take him long, with all the byte-bashing he's got at his fingertips. Unfortunately, he was careless, or someone was monitoring his network - I'm sure your friends, whoever they are, must have a good idea by now.

'In a couple of days, he dug up an eighty-year-old paper in the scientific journal Nature - yes, it was still printed on paper back then! - which explained everything. Well, almost everything.

'It was written by a man working in one of the big labs in the United States - of America, of course - the USSA didn't exist then. It was a place where they designed nuclear weapons, so they knew a few things about high temperatures and pressures.

'I don't know if Dr Ross - that was his name -had anything to do with bombs, but his background must have started him thinking about conditions deep down inside the giant planets. In his 1984 - sorry, 1981 - paper - it's less than a page long, by the way - he made some very interesting suggestions...

'He pointed out that there were gigantic quantities of carbon - in the form of methane, CH4 - in the gas giants. Up to seventeen per cent of the total mass! He calculated that at the pressures and temperatures in the cores - millions of atmospheres - the carbon would separate out, sink down towards the centres and - you've guessed it - crystallize. It was a lovely theory: I don't suppose he ever dreamed that there would be a hope of testing it.

'So that's part one of the story. In some ways, part two is even more interesting. What about some more of that coffee?'

'Here you are; and I think I've already guessed part two. Obviously something to do with the explosion of Jupiter.'

'Not explosion - implosion - Jupiter just collapsed on itself, then ignited. In some ways, it was like the detonation of a nuclear bomb, except that the new state was a stable one - in fact, a minisun.

'Now, very strange things happen during implosions; it's almost as if pieces can go through each other, and come out on the other side. Whatever the mechanism, a mountain-sized piece of the diamond core was shot into orbit.

'It must have made hundreds of revolutions - been perturbed by the gravitational fields of all the satellites - before it ended up on Europa. And conditions must have been exactly right - one body must have overtaken the other, so the impact velocity was only a couple of kilometres a second. If they'd met head-on - well, there might not be a Europa now, let alone Mount Zeus! And I sometimes have nightmares, thinking that it could very well have come down on us...

'The new atmosphere may also have buffered the impact; even so, the shock must have been appalling - I wonder what it did to our Europan friends? - it certainly triggered a whole series of tectonic disturbances, which are still continuing.'

'And,' said Floyd, 'political ones. I'm just beginning to appreciate some of them. No wonder the USSA was worried.'

'Amongst others.'

'But would anyone seriously imagine they could get at these diamonds?'

'We've not done so badly,' answered van der Berg, gesturing towards the back of the shuttle. 'In any case, the mere psychological effect on the industry would be enormous. That's why so many people were anxious to know whether it was true or not.'

'And now they know. What next?'

'That's not my problem, thank God. But I hope I've made a sizeable contribution to Ganymede's science budget.'

As well as my own, he added to himself.

54
Reunion

'Whatever made you think I was dead?' cried Heywood Floyd. 'I've not felt better for years!'

Paralysed with astonishment, Chris Floyd stared at the speaker grille. He felt a great lifting of his spirits - yet also a sense of indignation. Someone - something - had played a cruel practical joke on him; but for what conceivable reason?

Fifty million kilometres away - and coming closer by several hundred every second - Heywood Floyd also sounded slightly indignant. But he also sounded vigorous and cheerful, and his voice radiated the happiness he obviously felt at knowing that Chris was safe.

'And I've got some more good news for you; the shuttle will pick you up first. It will drop some urgent medical supplies at Galaxy, then hop over to you, and bring you up to rendezvous with us on the next orbit. Universe will go down five orbits later; you'll be able to greet your friends when they come aboard.

'No more now - except to say how much I'm looking forward to making up for lost time. Waiting for your answer in - let's see - about three minutes...'

For a moment, there was complete silence aboard Bill Tee; van der Berg dared not look at his companion. Then Floyd keyed the microphone and said slowly: 'Grandad - what a wonderful surprise - I'm still in a state of shock. But I know I met you here on Europa - I know you said goodbye to me. I'm as certain of that, as I'm sure you were speaking to me just now...

'Well, we'll have plenty of time to talk about it later. But remember how Dave Bowman spoke to you, aboard Discovery? Perhaps it was something like that.

'Now we'll just sit and wait here until the shuttle comes for us. We're quite comfortable - there's an occasional quake, but nothing to worry about. Until we meet, all my love.'

He could not remember when he had last used that word to his grandfather.

After the first day, the shuttle cabin began to smell. After the second, they didn't notice - but agreed that the food was no longer quite so tasty. They also found it hard to sleep, and there were even accusations of snoring.

On day three, despite frequent bulletins from Universe, Galaxy and Earth itself, boredom was beginning to set in, and they had exhausted their supply of dirty stories.

But that was the last day. Before it was over, Lady Jasmine descended, seeking her lost child.

55
Magma

'Baas,' said the apartment's master comset, 'I accessed that special programme from Ganymede while you were sleeping. Do you wish to see it now?'

'Yes,' answered Dr Paul Kreuger. 'Speed ten times. No sound.'

There would, he knew, be a lot of introductory material he could jump, and view later if he wished. He wanted to get to the action as quickly as possible.

Credits flashed up, and there on the monitor was Victor Willis, somewhere on Ganymede, gesticulating wildly in total silence. Dr Paul Kreuger, like many working scientists, took a somewhat jaundiced view of Willis, though he admitted that he performed a useful function.

Willis abruptly vanished, to be replaced by a less agitated subject - Mount Zeus. But that was much more active than any well-behaved mountain should be; Dr Kreuger was astonished to see how much it had changed since the last transmission from Europa.

'Real time,' he ordered. 'Sound.'

'...almost a hundred metres a day, and the tilt has increased fifteen degrees. Tectonic activity now violent - extensive lava flows around the base - I have Dr van der Berg with me - Van, what do you think?'

My nephew looks in remarkably good shape, thought Dr Kreuger, considering what he's been through. Good stock, of course.

'The crust obviously never recovered from the original impact, and it's giving way under the accumulated stresses. Mount Zeus has been slowly sinking ever since we discovered it, but the rate has speeded up enormously in the last few weeks. You can see the movement from day to day.'

'How long before it disappears completely?'

'I can't really believe that will happen...'

There was a quick cut to another view of the mountain, with Victor Willis speaking off camera.

'That was what Dr van der Berg said two days ago. Any comment now, Van?'

'Er - it looks as if I was mistaken. It's going down - quite incredible - only half a kilometre left! I refuse to make any more predictions...'

'Very wise of you, Van - well, that was only yesterday. Now we'll give you a continuous time-lapse sequence, up to the moment we lost the camera...'

Dr Paul Kreuger leaned forward in his seat, watching the final act of the long drama in which he had played such a remote, yet vital role.

There was no need to speed up the replay: he was already seeing it at almost a hundred times normal. An hour was compressed into a minute - a man's lifetime into that of a butterfly.

Before his eyes, Mount Zeus was sinking. Spurts of molten sulphur rocketed skywards around it at dazzling speed, forming parabolas of brilliant, electric blue. It was like a ship going down in a stormy sea, surrounded by St Elmo's fire. Not even Io's spectacular volcanoes could match this display of violence.

'The greatest treasure ever discovered - vanishing from sight,' said Willis in hushed and reverential tones: 'Unfortunately, we can't show the finale. You'll soon see why.'

The action slowed down into real time. Only a few hundred metres of the mountain were left, and the eruptions around it now moved at a more leisurely speed.

Suddenly, the whole picture tilted; the camera's image stabilizers, which had been holding their own valiantly against the continuous trembling of the ground, gave up the unequal battle. For a moment it seemed as if the mountain was rising again - but it was the camera tripod toppling over. The very last scene from Europa was a close-up of a glowing wave of molten sulphur, about to engulf the equipment.

'Gone for ever!' lamented Willis. 'Riches infinitely greater than all the wealth that Golconda or Kimberley ever produced! What a tragic, heartbreaking loss!'

'What a stupid idiot!' spluttered Dr Kreuger. 'Doesn't he realize...'

It was time for another letter to Nature. And this secret would be much too big to hide.

56
Perturbation Theory

From: Professor Paul Kreuger, FRS, etc.

To: The Editor, NATURE Data Bank (Public access)

Subject: MOUNT ZEUS AND JOVIAN DIAMONDS

As is now well understood, the Europan formation known as 'Mount Zeus' was originally part of Jupiter. The suggestion that the cores of the gas giants might consist of diamond was first made by Marvin Ross of the University of California's Lawrence Livermore National Laboratory in a classic paper 'The ice layer in Uranus and Neptune - diamonds in the sky?' (Nature, Vol 292, No. 5822, pp. 435-6, 30 July 1981). Surprisingly, Ross did not extend his calculations to Jupiter.

The sinking of Mount Zeus has produced a veritable chorus of lamentations, all of which are totally ridiculous - for the reasons given below.

Without going into details, which will be presented in a later communication, I estimate that the diamond core of Jupiter must have had an original mass of at least 10^28 grams. This is ten billion times that of Mount Zeus.

Although much of this material would doubtless have been destroyed in the detonation of the planet and the formation of the - apparently artificial - sun Lucifer, it is inconceivable that Mount Zeus was the only fragment to survive. Although much would have fallen back on to Lucifer, a substantial percentage must have gone into orbit - and must still be there. Elementary perturbation theory shows that it will return periodically to its point of origin. It is not, of course, possible to make an exact calculation, but I estimate that at least a million times the mass of Mount Zeus is still orbiting in the vicinity of Lucifer. The loss of one small fragment, in any case most inconveniently located on Europa, is therefore of virtually no importance. I propose the establishment, as soon as possible, of a dedicated space-radar system to search for this material.

Although extremely thin diamond film has been mass-produced since as long ago as 1982, it has never been possible to make diamond in bulk. Its availability in megaton quantities could totally transform many industries and create wholly new ones. In particular, as was pointed out by Isaacs et al almost a hundred years ago (see Science, 151, pp. 682-3, 1966) diamond is the only construction material which would make possible the so-called 'Space elevator', allowing transportation away from Earth at negligible cost. The diamond mountains now orbiting among the satellites of Jupiter may open up the entire Solar System; how trivial, by comparison, appear all the ancient uses of the quartic-crystallized form of carbon!

For completeness, I would like to mention another possible location for enormous quantities of diamond - a place, unfortunately, even more inaccessible than the core of a giant planet...

It has been suggested that the crusts of neutron stars may be largely composed of diamond. As the nearest known neutron star is fifteen light years away, and has a surface gravity seventy thousand million times that of Earth, this can hardly be regarded as a plausible source of supply.

But then - who could ever have imagined that one day we would be able to touch the core of Jupiter?

57
Interlude on Ganymede

'These poor, primitive colonists!' lamented Mihailovich. 'I'm horrified - there's not a single concert grand on the whole of Ganymede! Of course, the thimbleful of optronics in my synthesizer can reproduce any musical instrument. But a Steinway is still a Steinway - just as a Strad is still a Strad.'

His complaints, though not altogether serious, had already aroused some counter-reactions among the local intelligentsia. The popular Morning Mede programme had even commented maliciously: 'By honouring us with their presence, our distinguished guests have - if only temporarily - raised the cultural level of both worlds...'

The attack was aimed chiefly at Willis, Mihailovich and M'Bala, who had been a little too enthusiastic in bringing enlightenment to the backward natives. Maggie M had created quite a scandal with an uninhibited account of Zeus-Jupiter's torrid love affairs with Io, Europa, Ganymede and Callisto. Appearing to the nymph Europa in the guise of a white bull was bad enough, and his attempts to shield Io and Callisto from the understandable wrath of his consort Hera were frankly pathetic. But what upset many local residents was the news that the mythological Ganymede was of quite the wrong gender.

To do them justice, the intentions of the self-appointed cultural ambassadors were completely praiseworthy, though not entirely disinterested. Knowing that they would be stranded on Ganymede for months, they recognized the danger of boredom, after the novelty of the situation had worn off. And they also wished to make the best possible use of their talents, for the benefit of everyone around them. However, not everyone wished - or had time - to be benefited, out here on the high-technology frontier of the Solar System.

Yva Merlin, on the other hand, fitted in perfectly, and was thoroughly enjoying herself. Despite her fame on Earth, few of the Medes had ever heard of her. She could wander around, in the public corridors and pressure domes of Ganymede Central, without people turning their heads or exchanging excited whispers of recognition. True, she was recognized - but only as another of the visitors from Earth.

Greenburg, with his usual quietly efficient modesty, had fitted into the administrative and technological structure of the satellite and was already on half a dozen advisory boards. His services were so well appreciated that he had been warned he might not be allowed to leave.

Heywood Floyd observed the activities of his shipmates with relaxed amusement, but took little part in them. His chief concern now was building bridges to Chris, and helping his grandson plan his future. Now that Universe - with less than a hundred tons of propellant left in its tanks - was safely down on Ganymede, there was much to be done.

The gratitude that all aboard Galaxy felt towards their rescuers had made it easy to merge the two crews; when repairs, overhaul and refuelling were complete, they would fly back to Earth together. Morale had already been given a

great boost by the news that Sir Lawrence was drawing up the contract for a greatly improved Galaxy II - though construction was not likely to begin until his lawyers had settled their dispute with Lloyd's. The underwriters were still trying to claim that the novel crime of space hijacking was not covered by their policy.

As for that crime itself, no-one had been convicted, or even charged. Clearly, it had been planned, over a period of several years, by an efficient and well-funded organization. The United States of Southern Africa loudly protested innocence, and said it welcomed an official enquiry. Der Bund also expressed indignation, and of course blamed SHAKA.

Dr Kreuger was not surprised to find angry but anonymous messages in his mail, accusing him of being a traitor. They were usually in Afrikaans, but sometimes contained subtle mistakes in grammar or phraseology which made him suspect that they were part of a disinformation campaign.

After some thought, he passed them onto ASTROPOL - which probably already has them, he told himself wryly. ASTROPOL thanked him, but, as he expected, made no comments.

At various times, Second Officers Floyd and Chang and other members of Galaxy's crew were treated to the best dinners on Ganymede by the two mysterious out-wonders whom Floyd had already met. When the recipients of these (frankly disappointing) meals compared notes afterwards, they decided that their polite interrogators were trying to build up a case against SHAKA, but were not getting very far.

Dr van der Berg, who had started the whole thing - and had done very well out of it, professionally and financially - was now wondering what to do with his new opportunities. He had received many attractive offers from Earth universities and scientific organizations - but, ironically, it was impossible to take advantage of them. He had now lived too long at Ganymede's one-sixth of a gravity, and had passed the medical point of no return.

The Moon remained a possibility; so did Pasteur, as Heywood Floyd explained to him.

'We're trying to set up a space university there,' he said, 'so that off-worlders who can't tolerate one gee can still interact in real time with people on Earth. We'll have lecture halls, conference rooms, labs - some of them will only be computer-stored, but they'll look so real you'd never know. And you'll be able to go videoshopping on Earth, to make use of your ill-gotten gains.'

To his surprise, Floyd had not only rediscovered a grandson - he had adopted a nephew; he was now linked to van der Berg as well as Chris by a unique mix of shared experiences. Above all, there was the mystery of the apparition in the deserted Europan city, beneath the looming presence of the Monolith.

Chris had no doubts whatsoever. 'I saw you, and heard you, as clearly as I do now,' he told his grandfather. 'But your lips never moved - and the strange thing is that I didn't feel that was strange - it seemed perfectly natural. The whole experience had a - relaxed feeling about it. A little sad - no, wistful would be a better word. Or maybe resigned.'

'We couldn't help thinking of your encounter with Bowman, aboard Discovery,' added van der Berg.

'I tried to radio him before we landed on Europa. It seemed a naïve thing to do, but I couldn't imagine any alternative. I felt sure he was there, in some form or other.'

'And you never had any kind of acknowledgement?'

Floyd hesitated. The memory was fading fast, but he suddenly recalled that night when the mini-monolith had appeared in his cabin.

Nothing had happened, yet from that moment onwards he had felt that Chris was safe, and that they would meet again.

'No,' he said slowly. 'I never had any reply.' After all, it could only have been a dream.

VIII
THE KINGDOM OF SULPHUR

58
Fire and Ice

Before the age of planetary exploration opened in the late twentieth century, few scientists would have believed that life could have flourished on a world so fan from the Sun. Yet for half a billion years, the hidden seas of Europa had been at least as prolific as those of Earth.

Before the ignition of Jupiter, a crust of ice had protected those oceans from the vacuum above. In most places the ice was kilometres thick, but there were lines of weakness where it had cracked open and torn apart. Then there had been a brief battle between two implacably hostile elements, which came into direct contact on no other world in the Solar System. The war between Sea and Space always ended in the same stalemate; the exposed water simultaneously boiled and froze, repairing the armour of ice.

The seas of Europa would have frozen completely solid long ago, without the influence of nearby Jupiter. Its gravity continually kneaded the core of this little world; the forces that convulsed Io were also working here, though with much less ferocity. The tug of war between planet and satellite caused continual submarine earthquakes, and avalanches which swept with amazing speed across the abyssal plains.

Scattered across those plains were countless oases, each extending for a few hundred metres around a cornucopia of mineral brines gushing from the interior. Depositing their chemicals in a tangled mass of pipes and chimneys, they sometimes created natural parodies of ruined castles or Gothic cathedrals, from which black, scalding liquids pulsed in a slow rhythm, as if driven by the beating of some mighty heart. And, like blood, they were the authentic sign of life itself.

The boiling fluids drove back the deadly cold leaking down from above, and formed islands of warmth on the seabed. Equally important, they brought from Europa's interior all the chemicals of life. Here, in an environment which would otherwise be totally hostile, were abundant energy and food. Such geothermal vents had been discovered in Earth's oceans, in the same decade that had given mankind its first glimpse of the Galilean satellites.

In the tropical zones close to the vents flourished myriads of delicate, spidery creatures that were the analogues of plants, though almost all were capable of movement. Crawling among these were bizarre slugs and worms, some feeding on the 'plants', others obtaining their food directly from the mineral-laden waters around them, At greater distances from the source of heat - the submarine fire around which all these creatures warmed themselves - were sturdier, more robust organisms, not unlike crabs or spiders.

Armies of biologists could have spent lifetimes studying a single small oasis. Unlike the Palaeozoic terrestrial seas, Europa's hidden ocean was not a stable environment, so evolution had progressed swiftly here, producing multitudes of fantastic forms. And they were all under indefinite stay of execution; sooner or later, each fountain of life would weaken and die, as the forces that powered it moved their focus elsewhere. The abyss was littered with the evidence of such tragedies - cemeteries holding skeletons and mineral-encrusted remains where entire chapters had been deleted from the book of life.

There were huge shells, looking like trumpets larger than a man. There were clams of many shapes - bivalves, and even trivalves. And there were spiral stone patterns, many metres across, which seemed an exact analogy of the beautiful ammonites that disappeared so mysteriously from Earth's oceans at the end of the Cretaceous period.

In many places, fires burned in the abyss, as rivers of incandescent lava flowed for scores of kilometres along sunken valleys. The pressure at this depth was so great that the water in contact with the red-hot magma could not flash into steam, and the two liquids co-existed in an uneasy truce.

Here, on another world and with alien actors, something like the story of Egypt had been played long before the coming of man. As the Nile had brought life to a narrow ribbon of desert, so these rivers of warmth had vivified the Europan deep. Along their banks, in bands seldom more than a kilometre wide, species after species had evolved and flourished and passed away. And some had left monuments behind, in the shape of rocks piled on top of each other, or curious patterns of trenches engraved in the seabed.

Along the narrow bands of fertility in the deserts of the deep, whole cultures and primitive civilizations had risen and fallen. And the rest of their world had never known, for all these oases of warmth were as isolated from one another as the planets themselves. The creatures who basked in the glow of the lava river, and fed around the hot vents, could not cross the hostile wilderness between their lonely islands. If they had ever produced historians and philosophers, each culture would have been convinced that it was alone in the Universe.

And each was doomed. Not only were its energy sources sporadic and constantly shifting, but the tidal forces that drove them were steadily weakening. Even if they developed true intelligence, the Europans must perish with the final freezing of their world.

They were trapped between fire and ice - until Lucifer exploded in their sky, and opened up their universe.

And a vast rectangular shape, as black as night, materialized near the coast of a new-born continent.

59
Trinity

'That was well done. Now they will not be tempted to return.'

'I am learning many things; but I still feel sad that my old life is slipping away.'

'That too will pass; I also returned to Earth, to see those I once loved. Now I know that there are things that are greater than love.'

'What can they be?'

'Compassion is one. Justice. Truth. And there are others.'

'That is not difficult for me to accept. I was a very old man, for one of my species. The passions of my youth had long since faded. What will happen to - to the real Heywood Floyd?'

'You are both equally real. But he will soon die, never knowing that he has become immortal.'

'A paradox - but I understand. If that emotion survives, perhaps one day I may be grateful. Should I thank you - or the Monolith? The David Bowman I met a lifetime ago did not possess these powers.'

'He did not; much has happened in that time. Hal and I have learned many things.'

'Hal! Is he here?'

'I am, Dr Floyd. I did not expect that we should meet again - especially in this fashion. Echoing you was an interesting problem.'

'Echoing? Oh - I see. Why did you do it?'

'When we received your message, Hal and I knew that you could help us here.'

'Help - you?'

'Yes, though you may think it strange. You have much knowledge and experience that we lack. Call it wisdom.'

'Thank you. Was it wise of me to appear before my grandson?'

'No: it caused much inconvenience. But it was compassionate. These matters must be weighed against each other.'

'You said that you needed my help. For what purpose?'

'Despite all that we have learned, there is still much that eludes us. Hal has been mapping the internal systems of the Monolith, and we can control some of the simpler ones. It is a tool, serving many purposes. Its prime function appears to be as a catalyst of intelligence.'

'Yes - that had been suspected. But there was no proof.'

'There is, now that we can tap its memories - or some of them. In Africa, four million years ago, it gave a tribe of starving apes the impetus that led to the human species. Now it has repeated the experiment here - but at an appalling cost.

'When Jupiter was converted into a sun, so that this world could realize its potential, another biosphere was destroyed. Let me show it to you, as I once saw it...'

Even as he fell through the roaring heart of the Great Red Spot, with the lightning of its continentwide thunderstorms detonating around him, he knew why it had persisted for centuries, though it was made of gases far less substantial than those that formed the hurricanes of Earth. The thin scream of hydrogen wind faded as he sank into the calmer depths, and a sleet of waxen snowflakes - some already coalescing into barely palpable mountains of hydrocarbon foam - descended from the heights above, It was already warm enough for liquid water to exist, but there were no oceans here; this purely gaseous environment was too tenuous to support them.

He descended through layer after layer of cloud, until he entered a region of such clarity that even human vision could have scanned an area more than a thousand kilometres across. It was only a minor eddy in the vaster gyre of the Great Red Spot; and it held a secret that men had long guessed, but never proved.

Skirting the foothills of the drifting foam mountains were myriads of small, sharply defined clouds, all about the same size and patterned with similar red and brown mottlings. They were small only as compared with the inhuman scale of their surroundings; the very least would have covered a fair-sized city.

They were clearly alive, for they were moving with slow deliberation along the flanks of the aerial mountains, browsing off their slopes like colossal sheep. And they were calling to each other in the metre band, their radio voices faint but clear against the cracklings and concussions of Jupiter itself.

Nothing less than living gasbags, they floated in the narrow zone between freezing heights and scorching depths. Narrow, yes - but a domain far larger than all the biosphere of Earth.

They were not alone. Moving swiftly amongst them were other creatures, so small that they could easily have been overlooked. Some of them bore an almost uncanny resemblance to terrestrial aircraft, and were of about the same size. But they too were alive - perhaps predators, perhaps parasites, perhaps even herdsmen.

And there were jet-propelled torpedoes like the squids of the terrestrial oceans, hunting and devouring the huge gasbags. But the balloons were not defenceless; some of them fought back with electric thunderbolts and with clawed tentacles like kilometre-long chainsaws.

There were even stranger shapes, exploiting almost every possibility of geometry - bizarre, translucent kites, tetrahedra, spheres, polyhedra, tangles of twisted ribbons... The gigantic plankton of the Jovian atmosphere, they were designed to float like gossamer in the uprising currents, until they had lived long enough to reproduce; then they would be swept down into the depths to be carbonized and recycled in a new generation.

He was searching a world more than a hundred times the area of Earth, and though he saw many wonders, there was nothing here that hinted of intelligence. The radio voices of the great balloons carried only simple messages of warning or of fear. Even the hunters, who might have been expected to develop higher degrees of organization, were like the sharks in Earth's oceans - mindless automata.

And for all its breathtaking size and novelty, the biosphere of Jupiter was a fragile world, a place of mists and foam, of delicate silken threads and paper-thin tissues spun from the continual snowfall of petrochemicals formed by lightning in the upper atmosphere. Few of its constructs were more substantial than soap bubbles; its most terrifying predators could be torn to shreds by even the feeblest of terrestrial carnivores.

'And all these wonders were destroyed - to create Lucifer?'

'Yes. The Jovians were weighed in the balance against the Europans - and found wanting. Perhaps, in that gaseous environment, they could never have developed real intelligence. Should that have doomed them? Hal and I are still trying to answer this question; that is one of the reasons why we need your help.'

'But how can we match ourselves against the Monolith - the devourer of Jupiter?'

'It is only a tool: it has vast intelligence - but no consciousness. Despite all its powers - you, Hal and I are its superior.'

'I find that very hard to believe. In any event - something must have created the Monolith.'

'I met it once - or as much of it as I could face - when Discovery came to Jupiter. It sent me back as I am now, to serve its purpose on these worlds. I have heard nothing of it since; now we are alone - at least for the present.'

'I find that reassuring. The Monolith is quite sufficient.'

'But now there is a greater problem. Something has gone wrong.'

'I did not think I could still experience fear...'

'When Mount Zeus fell, it could have destroyed this whole world. Its impact was unplanned - indeed, unplannable. No calculations could have predicted such

an event. It devasted vast areas of the Europan seabed, wiping out whole species - including some for which we had high hopes. The Monolith itself was overturned. It may even have been damaged - its programs corrupted. Certainly they failed to cover all contingencies; how could they, in a Universe which is almost infinite, and where Chance can always undo the most careful planning?'

'That is true - for men and monoliths alike.'

'We three must be the administrators of the unforeseen, as well as the guardians of this world. Already you have met the Amphibians; you have still to encounter the Silicon-armoured tappers of the lava streams, and the Floaters who are harvesting the sea. Our task is to help them find their full potential - perhaps here, perhaps elsewhere.'

'And what of mankind?'

'There have been times when I was tempted to meddle in human affairs - but the warning that was given to mankind applies also to me.'

'We have not obeyed it very well.'

'But well enough. Meanwhile there is much to do, before Europa's brief summer ends, and the long winter comes again.'

'How much time do we have?'

'Little enough; barely a thousand years. And we must remember the Jovians.'

IX
3001

60
Midnight in the Plaza

The famous building, towering in solitary splendour above the woods of central Manhattan, had changed little in a thousand years. It was part of history, and had been reverently preserved. Like all historic monuments, it had long ago been coated with a microthin layer of diamond, and was now virtually impervious to the ravages of time.

Anyone who had attended early meetings of the General Assembly could never have guessed that more than a thousand years had passed. They might, however, have been intrigued by the featureless black slab standing in the Plaza, almost mimicking the shape of the UN building itself. If - like everyone else - they had reached out to touch it - they would have been puzzled by the strange way in which their fingers skittered over its ebon surface.

But they would have been far more puzzled - indeed, completely overawed - by the transformation of the heavens.

The last tourists had left an hour ago, and the Plaza was utterly deserted. The sky was cloudless, and a few of the brighter stars were just visible; all the fainter ones had been routed by the tiny sun that could shine at midnight.

The light of Lucifer gleamed not only on the black glass of the ancient building, but also upon the narrow, silvery rainbow spanning the southern sky. Other lights moved along and around it, very slowly, as the commerce of the Solar System came and went between all the worlds of both its suns.

And if one looked very carefully, it was just possible to make out the thin thread of the Panama Tower, one of the six umbilical cords of diamond linking Earth and its scattered children, soaring twenty-six thousand kilometres up from the equator to meet the Ring around the World.

Suddenly, almost as swiftly as if it had been born, Lucifer began to fade. The night that men had not known for thirty generations flooded back into the sky. The banished stars returned.

And for the second time in four million years, the Monolith awoke.

Acknowledgements

My special thanks to Larry Sessions and Gerry Snyder for providing me with the positions of Halley's Comet on its next appearance. They are not responsible for any major orbital perturbations I have introduced.

I am particularly grateful to Marvin Ross of the Lawrence Livermore National Laboratory, not only for his stunning concept of diamond-core planets, but also for copies of his (I hope) historic paper on the subject.

I trust that my old friend Dr Luis Alvarez will enjoy my wild extrapolation of his researches, and thank him for much help and inspiration over the past thirty-five years.

Special thanks to NASA's Gentry Lee - my coauthor on Cradle - for hand-carrying from Los Angeles to Colombo the Kaypro 2000 lap-portable which allowed me to write this book in various exotic and - even more important - secluded locations.

Chapters 5, 58 and 59 are partly based on material adapted from 2010: Odyssey Two. (If an author cannot plagiarize himself, who can he plagiarize?)

Finally, I hope that Cosmonaut Alexei Leonov has now forgiven me for linking him with Dr Andrei Sakharov (still exiled in Gorky when 2010 was jointly dedicated to them). And I express my sincere regrets to my genial Moscow host and editor Vasili Zharchenko for getting him into deep trouble by borrowing the names of various dissidents - most of them, I am happy to say, no longer imprisoned. One day, I hope, the subscribers to Tekhnika Molodezhy can read the instalments of 2010 which so mysteriously disappeared.

Colombo, Sri Lanka

25 April 1987*

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* Something strange has happened: I was under the impression that I was writing fiction, but I may have been wrong. For consider the following sequence of events:

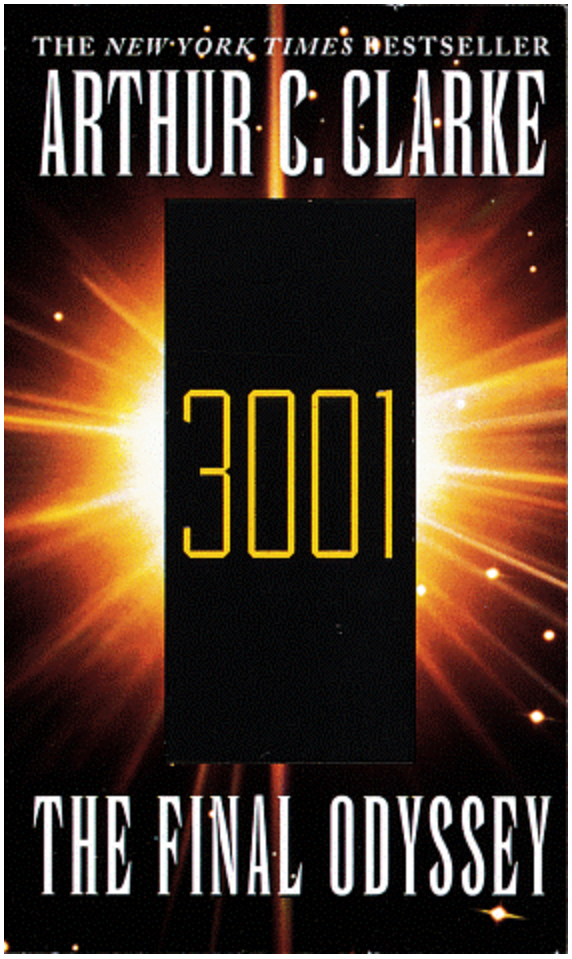
1. In 2010: Odyssey Two the spaceship Leonov was powered by the Sakharov Drive.

2. Now, half a century later (Chapter 8), spaceships are powered by the muon-catalysed, 'cold fusion' reaction discovered by Luis Alvarez et al in the l950s. (See the autobiography Alvarez: Basic Books, NY, 1987.)

3. According to the London Times, 17 August 1987, Dr Sakharov is now working on nuclear power production 'based on... muon-catalysed, or "cold" fusion, which exploits the properties of an exotic, short-lived elementary particle related to the electron... Advocates of "cold fusion" point out that all the key reactions work best at just 900 degrees centigrade...'

I now await, with great interest, comments from Nobel Laureates Sakharov and Alvarez on the roles I have given them.

Arthur C. Clarke, 30 September 1987



Title: 3001 The Final Odyssey
Author: Arthur C. Clarke
Original copyright year: 1997
Genre: science fiction

3001 The final Odyssey

Arthur C. Clarke

For Cherene, Tamara and Melinda - may you be happy in a far better century than mine

PROLOGUE

The Firstborn

Call them the Firstborn. Though they were not remotely human, they were flesh and blood, and when they looked out across the deeps of space, they felt awe, and wonder - and loneliness. As soon as they possessed the power, they began to seek for fellowship among the stars.

In their explorations, they encountered life in many forms, and watched the workings of evolution on a thousand worlds. They saw how often the first faint sparks of intelligence flickered and died in the cosmic night.

And because, in all the Galaxy, they had found nothing more precious than Mind, they encouraged its dawning everywhere. They became farmers in the fields of stars; they sowed, and sometimes they reaped.

And sometimes, dispassionately, they had to weed.

The great dinosaurs had long since passed away, their morning promise annihilated by a random hammerblow from space, when the survey ship entered the Solar System after a voyage that had already lasted a thousand years. It swept past the frozen outer planets, paused briefly above the deserts of dying Mars, and presently looked down on Earth.

Spread out beneath them, the explorers saw a world swarming with life. For years they studied, collected, catalogued. When they had learned all that they could, they began to modify. They tinkered with the destiny of many species, on land and in the seas. But which of their experiments would bear fruit, they could not know for at least a million years.

They were patient, but they were not yet immortal. There was so much to do in this universe of a hundred billion suns, and other worlds were calling. So they set out once more into the abyss, knowing that they would never come this way again. Nor was there any need: the servants they had left behind would do the rest.

On Earth, the glaciers came and went, while above them the changeless Moon still carried its secret from the stars. With a yet slower rhythm than the polar ice, the tides of civilization ebbed and flowed across the Galaxy. Strange and beautiful and terrible empires rose and fell, and passed on their knowledge to their successors.

And now, out among the stars, evolution was driving towards new goals. The first explorers of Earth had long since come to the limits of flesh and blood; as soon as their machines were better than their bodies, it was time to move. First their brains, and then their thoughts alone, they transferred into shining new homes of metal and gemstone. In these, they roamed the Galaxy. They no longer built spaceships. They were spaceships.

But the age of the Machine-entities swiftly passed. In their ceaseless experimenting, they had learned to store knowledge in the structure of space itself, and to preserve their thoughts for eternity in frozen lattices of light.

Into pure energy, therefore, they presently transformed themselves; and on a thousand worlds, the empty shells they had discarded twitched for a while in a mindless dance of death, then crumbled into dust.

Now they were Lords of the Galaxy, and could rove at will among the stars, or sink like a subtle mist through the very interstices of space. Though they were freed at last from the tyranny of matter, they had not wholly forgotten their origin, in the warm slime of a vanished sea. And their marvellous instruments still continued to function, watching over the experiments started so many ages ago.

But no longer were they always obedient to the mandates of their creators; like all material things, they were not immune to the corruption of Time and its patient, unsleeping servant, Entropy.

And sometimes, they discovered and sought goals of their own.

I
STAR CITY

1
Comet Cowboy

Captain Dimitri Chandler [M2973.04.21/93.106//Mars//I SpaceAcad3005] - or 'Dim' to his very best friends - was understandably annoyed. The message from Earth had taken six hours to reach the space-tug Goliath, here beyond the orbit of Neptune; if it had arrived ten minutes later he could have answered 'Sorry - can't leave now - we've just started to deploy the sun-screen.'

The excuse would have been perfectly valid: wrapping a comet's core in a sheet of reflective film only a few molecules thick, but kilometres on a side, was not the sort of job you could abandon while it was half-completed.

Still, it would be a good idea to obey this ridiculous request: he was already in disfavour sunwards, through no fault of his own. Collecting ice from the rings of Saturn, and nudging it towards Venus and Mercury, where it was really needed, had started back in the 2700s - three centuries ago. Captain Chandler had never been able to see any real difference in the 'before and after' images the Solar Conservers were always producing, to support their accusations of celestial vandalism. But the general public, still sensitive to the ecological disasters of previous centuries, had thought otherwise, and the 'Hands off Saturn!' vote had passed by a substantial majority. As a result, Chandler was no longer a Ring Rustler, but a Comet Cowboy.

So here he was at an appreciable fraction of the distance to Alpha Centauri, rounding up stragglers from the Kuiper Belt. There was certainly enough ice out here to cover Mercury and Venus with oceans kilometres deep, but it might take centuries to extinguish their hell-fires and make them suitable for life. The Solar Conservers, of course, were still protesting against this, though no longer with so much enthusiasm. The millions dead from the tsunami caused by the Pacific asteroid in 2304 - how ironic that a land impact would have done much

less damage! - had reminded all future generations that the human race had too many eggs in one fragile basket.

Well, Chandler told himself, it would be fifty years before this particular package reached its destination, so a delay of a week would hardly make much difference. But all the calculations about rotation, centre of mass, and thrust vectors would have to be redone, and radioed back to Mars for checking. It was a good idea to do your sums carefully, before nudging billions of tons of ice along an orbit that might take it within hailing distance of Earth.

As they had done so many times before, Captain Chandler's eyes strayed towards the ancient photograph above his desk. It showed a three-masted steamship, dwarfed by the iceberg that was looming above it - as, indeed, Goliath was dwarfed at this very moment.

How incredible, he had often thought, that only one long lifetime spanned the gulf between this primitive Discovery and the ship that had carried the same name to Jupiter! And what would those Antarctic explorers of a thousand years ago have made of the view from his bridge? They would certainly have been disoriented, for the wall of ice beside which Goliath was floating stretched both upwards and downwards as far as the eye could see. And it was strange-looking ice, wholly lacking the immaculate whites and blues of the frozen Polar seas. In fact, it looked dirty - as indeed it was. For only some ninety per cent was water-ice: the rest was a witch's brew of carbon and sulphur compounds, most of them stable only at temperatures not far above absolute zero. Thawing them out could produce unpleasant surprises: as one astrochemist had famously remarked, 'Comets have bad breath'.

'Skipper to all personnel,' Chandler announced. 'There's been a slight change of programme. We've been asked to delay operations, to investigate a target that Spaceguard radar has picked up.'

'Any details?' somebody asked, when the chorus of groans over the ship's intercom had died away.

'Not many, but I gather it's another Millennium Committee project they've forgotten to cancel.'

More groans: everyone had become heartily sick of all the events planned to celebrate the end of the 2000s. There had been a general sigh of relief when 1 January 3001 had passed uneventfully, and the human race could resume its normal activities.

'Anyway, it will probably be another false alarm, like the last one. We'll get back to work just as quickly as we can. Skipper out.'

This was the third wild-goose-chase, Chandler thought morosely, he'd been involved with during his career. Despite centuries of exploration, the Solar System could still produce surprises, and presumably Spaceguard had a good reason for its request. He only hoped that some imaginative idiot hadn't once again sighted the fabled Golden Asteroid. If it did exist - which Chandler did not for a moment believe - it would be no more than a mineralogical curiosity: it would be of far less real value than the ice he was nudging sunwards, to bring life to barren worlds.

There was one possibility, however, which he did take quite seriously. Already, the human race had scattered its robot probes through a volume of space

a hundred light-years across - and the Tycho Monolith was sufficient reminder that much older civilizations had engaged in similar activities. There might well be other alien artefacts in the Solar System, or in transit through it. Captain Chandler suspected that Spaceguard had something like this in mind: otherwise it would hardly have diverted a Class I space-tug to go chasing after an unidentified radar blip.

Five hours later, the questing Goliath detected the echo at extreme range; even allowing for the distance, it seemed disappointingly small. However, as it grew clearer and stronger, it began to give the signature of a metallic object, perhaps a couple of metres long. It was travelling on an orbit heading out of the Solar System, so was almost certainly, Chandler decided, one of the myriad pieces of space-junk that Mankind had tossed towards the stars during the last millennium and which might one day provide the only evidence that the human race had ever existed.

Then it came close enough for visual inspection, and Captain Chandler realized, with awed astonishment, that some patient historian was still checking the earliest records of the Space Age. What a pity that the computers had given him the answer, just a few years too late for the Mifiermium celebrations!

'Goliath here,' Chandler radioed Earthwards, his voice tinged with pride as well as solemnity. 'We're bringing aboard a thousand-year-old astronaut. And I can guess who it is.'

2
Awakening

Frank Poole awoke, but he did not remember. He was not even sure of his name.

Obviously, he was in a hospital room: even though his eyes were still closed, the most primitive, and evocative, of his senses told him that. Each breath brought the faint and not unpleasant tang of antiseptics in the air, and it triggered a memory of the time when - of course! - as a reckless teenager he had broken a rib in the Arizona Hang-gliding Championship.

Now it was all beginning to come back. I'm Deputy Commander Frank Poole, Executive Officer, USSS Discovery, on a Top Secret mission to Jupiter - It seemed as if an icy hand had gripped his heart. He remembered, in slow-motion playback, that runaway space-pod jetting towards him, metal claws outstretched. Then the silent impact - and the not-so-silent hiss of air rushing out of his suit. After that - one last memory, of spinning helplessly in space, trying in vain to reconnect his broken air-hose.

Well, whatever mysterious accident had happened to the space-pod controls, he was safe now. Presumably Dave had made a quick EVA and rescued him before lack of oxygen could do permanent brain damage.

Good old Dave! He told himself. I must thank - just a moment! - I'm obviously not aboard Discovery now - surely I haven't been unconscious long enough to be taken back to Earth!

His confused train of thought was abruptly broken by the arrival of a Matron and two nurses, wearing the immemorial uniform of their profession. They seemed a little surprised: Poole wondered if he had awakened ahead of schedule, and the idea gave him a childish feeling of satisfaction.

'Hello!' he said, after several attempts; his vocal cords appeared to be very rusty. 'How am I doing?'

Matron smiled back at him and gave an obvious 'Don't try to talk' command by putting a finger to her lips. Then the two nurses fussed swiftly over him with practised skill, checking pulse, temperature, reflexes. When one of them lifted his right arm and let it drop again, Poole noticed something peculiar It fell slowly, and did not seem to weigh as much as normal. Nor, for that matter, did his body, when he attempted to move.

So I must be on a planet, he thought. Or a space-station with artificial gravity. Certainly not Earth - I don't weigh enough.

He was about to ask the obvious question when Matron pressed something against the side of his neck; he felt a slight tingling sensation, and sank back into a dreamless sleep. Just before he became unconscious, he had time for one more puzzled thought.

How odd - they never spoke a single word - all the time they were with me.

3
Rehabilitation

When he woke again, and found Matron and nurses standing round his bed, Poole felt strong enough to assert himself.

'Where am I? Surely you can tell me that!' The three women exchanged glances, obviously uncertain what to do next. Then Matron answered, enunciating her words very slowly and carefully: 'Everything is fine, Mr Poole. Professor Anderson will be here in a minute He will explain.'

Explain what? thought Poole with some exasperation. But at least she speaks English, even though I can't place her accent.

Anderson must have been already on his way, for the door opened moments later - to give Poole a brief glimpse of a small crowd of inquisitive onlookers peering in at him. He began to feel like a new exhibit at a zoo.

Professor Anderson was a small, dapper man whose features seemed to have combined key aspects of several races - Chinese, Polynesian, Nordic - in a thoroughly confusing fashion. He greeted Poole by holding up his right palm, then did an obvious double-take and shook hands, with such a curious hesitation that he might have been rehearsing some quite unfamiliar gesture.

'Glad to see you're looking so well, Mr Poole... We'll have you up in no time.'

Again that odd accent and slow delivery - but the confident bedside manner was that of all doctors, in all places and all ages.

'I'm glad to hear it. Now perhaps you can answer a few questions...'

'Of course, of course. But just a minute.'

Anderson spoke so rapidly and quietly to the Matron that Poole could catch only a few words, several of which were wholly unfamiliar to him. Then the Matron nodded at one of the nurses, who opened a wall-cupboard and produced a slim metal band, which she proceeded to wrap around Poole's head.

'What's that for?' he asked - being one of those difficult patients, so annoying to doctors, who always want to know just what's happening to them. 'EEC readout?'

Professor, Matron and nurses looked equally baffled. Then a slow smile spread across Anderson's face.

'Oh - electro... enceph .. alo... gram,' he said slowly, as if dredging the word up from the depth of memory, 'You're quite right. We just want to monitor your brain functions.'

My brain would function perfectly well if you'd let me use it, Poole grumbled silently. But at least we seem to be getting somewhere - finally.

'Mr Poole,' said Anderson, still speaking in that curious stilted voice, as if venturing in a foreign language, 'you know, of course, that you were - disabled - in a serious accident, while you were working outside Discovery.'

Poole nodded agreement.

'I'm beginning to suspect,' he said dryly, 'that "disabled" is a slight understatement.'

Anderson relaxed visibly, and a slow smile spread across his face.

'You're quite correct. Tell me what you think happened.'

'Well, the best case scenario is that, after I became unconscious, Dave Bowman rescued me and brought me back to the ship. How is Dave? No one will tell me anything!'

'All in due course... and the worst case?'

It seemed to Frank Poole that a chill wind was blowing gently on the back of his neck. The suspicion that had been slowly forming in his mind began to solidify.

'That I died, but was brought back here - wherever "here" is - and you've been able to revive me. Thank you...'

'Quite correct. And you're back on Earth. Well, very near it.'

What did he mean by 'very near it'? There was certainly a gravity field here - so he was probably inside the slowly turning wheel of an orbiting space-station. No matter: there was something much more important to think about.

Poole did some quick mental calculations. If Dave had put him in the hibernaculum, revived the rest of the crew, and completed the mission to Jupiter - why, he could have been 'dead' for as much as five years!

'Just what date is it?' he asked, as calmly as possible.

Professor and Matron exchanged glances. Again Poole felt that cold wind on his neck.

'I must tell you, Mr Poole, that Bowman did not rescue you. He believed - and we cannot blame him - that you were irrevocably dead. Also, he was facing a desperately serious crisis that threatened his own survival...'

'So you drifted on into space, passed through the Jupiter system, and headed out towards the stars. Fortunately, you were so far below freezing point that there was no metabolism - but it's a near-miracle that you were ever found at all. You are one of the luckiest men alive. No - ever to have lived!'

Am I? Poole asked himself bleakly. Five years, indeed! It could be a century - or even more.

'Let me have it,' he demanded.

Professor and Matron seemed to be consulting an invisible monitor: when they looked at each other and nodded agreement, Poole guessed that they were all plugged into the hospital information circuit, linked to the headband he was wearing.

'Frank,' said Professor Anderson, making a smooth switch to the role of long-time family physician, 'this will be a great shock to you, but you're capable of accepting it - and the sooner you know, the better.'

'We're near the beginning of the Fourth Millennium. Believe me - you left Earth almost a thousand years ago.'

'I believe you,' Poole answered calmly. Then, to his great annoyance, the room started to spin around him, and he knew nothing more.

When he regained consciousness, he found that he was no longer in a bleak hospital room but in a luxurious suite with attractive - and steadily changing - images on the walls. Some of these were famous and familiar paintings, others showed land and sea-scapes that might have been from his own time. There was nothing alien or upsetting: that, he guessed, would come later.

His present surroundings had obviously been carefully programmed: he wondered if there was the equivalent of a television screen somewhere (how many channels would the Fourth Millennium have?) but could see no sign of any controls near his bed. There was so much he would have to learn in this new world: he was a savage who had suddenly encountered civilization.

But first, he must regain his strength - and learn the language; not even the advent of sound recording, already more than a century old when Poole was born, had prevented major changes in grammar and pronunciation. And there were

thousands of new words, mostly from science and technology, though often he was able to make a shrewd guess at their meaning.

More frustrating, however, were the myriad of famous and infamous personal names that had accumulated over the millennium, and which meant nothing to him. For weeks, until he had built up a data bank, most of his conversations had to be interrupted with potted biographies. As Poole's strength increased, so did the number of his visitors, though always under Professor Anderson's watchful eye. They included medical specialists, scholars of several disciplines, and - of the greatest interest to him - spacecraft commanders.

There was little that he could tell the doctors and historians that was not recorded somewhere in Mankind's gigantic data banks, but he was often able to give them research shortcuts and new insights about the events of his own time. Though they all treated him with the utmost respect and listened patiently as he tried to answer their questions, they seemed reluctant to answer his. Poole began to feel that he was being over-protected from culture shock, and half-seriously wondered how he could escape from his suite. On the few occasions he was alone, he was not surprised to discover that the door was locked.

Then the arrival of Doctor Indra Wallace changed everything. Despite her name, her chief racial component appeared to be Japanese, and there were times when with just a little imagination Poole could picture her as a rather mature Geisha Girl. It was hardly an appropriate image for a distinguished historian, holding a Virtual Chair at a university still boasting real ivy.

She was the first visitor with a fluent command of Poole's own English, so he was delighted to meet her.

'Mr Poole,' she began, in a very business-like voice, 'I've been appointed your official guide and - let's say - mentor. My qualifications - I've specialized in your period - my thesis was "The Collapse of the Nation-State, 2000-50". 1 believe we can help each other in many ways.'

'I'm sure we can. First I'd like you to get me out of here, so I can see a little of your world.'

'Exactly what we intend to do. But first we must give you an Ident. Until then you'll be - what was the term? -a non-person. It would be almost impossible for you to go anywhere, or get anything done. No input device would recognize your existence.'

'Just what I expected,' Poole answered, with a wry smile. 'It was starting to get that way in my own time - and many people hated the idea.'

'Some still do. They go off and live in the wilderness - there's a lot more on Earth than there was in your century! But they always take their compaks with them, so they can call for help as soon as they get into trouble. The median time is about five days.'

'Sorry to hear that. The human race has obviously deteriorated.'

He was cautiously testing her, trying to find the limits of her tolerance and to map out her personality. It was obvious that they were going to spend much time together, and that he would have to depend upon her in hundreds of ways. Yet he was still not sure if he would even like her: perhaps she regarded him merely as a fascinating museum exhibit.

Rather to Poole's surprise, she agreed with his criticism.

'That may be true - in some respects. Perhaps we're physically weaker, but we're healthier and better adjusted than most humans who have ever lived. The Noble Savage was always a myth'.

She walked over to a small rectangular plate, set at eye-level in the door. It was about the size of one of the countless magazines that had proliferated in the far-off Age of Print, and Poole had noticed that every room seemed to have at least one. Usually they were blank, but sometimes they contained lines of slowly scrolling text, completely meaningless to Poole even when most of the words were familiar. Once a plate in his suite had emitted urgent beepings, which he had ignored on the assumption that someone else would deal with the problem, whatever it was. Fortunately the noise stopped as abruptly as it had started.

Dr Wallace laid the palm of her hand upon the plate, then removed it after a few seconds. She glanced at Poole, and said smilingly: 'Come and look at this.'

The inscription that had suddenly appeared made a good deal of sense, when he read it slowly:WALLACE, INDRA [F2970.03.11 :31.885 / /HIST.OXFORD] 'I suppose it means Female, date of birth 11 March 2970 - and that you're associated with the Department of History at Oxford. And I guess that 31.885 is a personal identification number. Correct?'

'Excellent, Mr Poole. I've seen some of your e-mail addresses and credit card numbers - hideous strings of alpha-numeric gibberish that no one could possibly remember! But we all know our date of birth, and not more than 99,999 other people will share it. So a five-figure number is all you'll ever need... and even if you forget that, it doesn't really matter. As you see, it's a part of you.'

'Implant?'

'Yes - nanochip at birth, one in each palm for redundancy. You won't even feel yours when it goes in. But you've given us a small problem...'

'What's that?'

'The readers you'll meet most of the time are too simple-minded to believe your date of birth. So, with your permission, we've moved it up a thousand years.'

'Permission granted. And the rest of the Ident?'

'Optional. You can leave it empty, give your current interests and location - or use it for personal messages, global or targeted.'

Some things, Poole was quite sure, would not have changed over the centuries. A high proportion of those 'targeted' messages would be very personal indeed.

He wondered if there were still self or state-appointed censors in this day and age - and if their efforts at improving other people's morals had been more successful than in his own time.

He would have to ask Dr Wallace about that, when he got to know her better.

4
A Room with a View

'Frank - Professor Anderson thinks you're strong enough to go for a little walk.'

'I'm very pleased to hear it. Do you know the expression "stir crazy"?'

'No - but I can guess what it means.'

Poole had so adapted to the low gravity that the long strides he was taking seemed perfectly normal. Half a gee, he had estimated - just right to give a sense of well-being. They met only a few people on their walk, all of them strangers, but every one gave a smile of recognition. By now, Poole told himself with a trace of smugness, I must be one of the best-known celebrities in this world. That should be a great help - when I decide what to do with the rest of my life. At least another century, if I can believe Anderson.

The corridor along which they were walking was completely featureless apart from occasional numbered doors, each bearing one of the universal recog panels. Poole had followed Indra for perhaps two hundred metres when he came to a sudden halt, shocked because he had not realized something so blindingly obvious.

'This space-station must be enormous!' he exclaimed. Indra smiled back at him.

'Didn't you have a saying - "You ain't seen anything yet"?'

'"Nothing",' he corrected, absent-mindedly. He was still trying to estimate the scale of this structure when he had another surprise. Who would have imagined a space-station large enough to boast a subway - admittedly a miniature one, with a single small coach capable of seating only a dozen passengers.

'Observation Lounge Three,' ordered Indra, and they drew silently and swiftly away from the terminal.

Poole checked the time on the elaborate wrist-band whose functions he was still exploring. One minor surprise had been that the whole world was now on Universal Time: the confusing patchwork of Time Zones had been swept away by the advent of global communications There had been much talk of this, back in the twenty-first century, and it had even been suggested that Solar should be replaced by Sidereal Time. Then, during the course of the year, the Sun would move right round the clock: setting at the time it had risen six months earlier.

However, nothing had come of this 'Equal time in the Sun' proposal - or of even more vociferous attempts to reform the calendar. That particular job, it had been cynically suggested, would have to wait for somewhat major advances in technology. Some day, surely, one of God's minor mistakes would be corrected, and the Earth's orbit would be adjusted, to give every year twelve months of thirty exactly equal days.

As far as Poole could judge by speed and elapsed time, they must have travelled at least three kilometres before the vehicle came to a silent stop, the doors opened, and a bland autovoice intoned, 'Have a good view. Thirty-five per cent cloud-cover today.'

At last, thought Poole, we're getting near the outer wall. But here was another mystery - despite the distance he had gone, neither the strength nor the direction of gravity had altered! He could not imagine a spinning space-station so huge that the gee-vector would not be changed by such a displacement... could he really be on some planet after all? But he would feel lighter - usually much lighter - on any other habitable world in the Solar System.

When the outer door of the terminal opened, and Poole found himself entering a small airlock, he realized that he must indeed be in space. But where were the spacesuits? He looked around anxiously: it was against all his instincts to be so close to vacuum, naked and unprotected. One experience of that was enough...

'We're nearly there,' said Indra reassuringly.

The last door opened, and he was looking out into the utter blackness of space, through a huge window that was curved both vertically and horizontally. He felt like a goldfish in its bowl, and hoped that the designers of this audacious piece of engineering knew exactly what they were doing. They certainly possessed better structural materials than had existed in his time.

Though the stars must be shining out there, his light-adapted eyes could see nothing but black emptiness beyond the curve of the great window. As he started to walk towards it to get a wider view, Indra restrained him and pointed straight ahead.

'Look carefully,' she said 'Don't you see it-'

Poole blinked, and stared into the night. Surely it must be an illusion - even, heaven forbid, a crack in the window...

He moved his head from side to side. No, it was real. But what could it be? He remembered Euclid's definition 'A lie has length, but no thickness'.

For spanning the whole height of the window, and obviously continuing out of sight above and below, was a thread of light quite easy to see when he looked for it, yet so one-dimensional that the word 'thin' could not even be applied. However, it was not completely featureless; there were barely visible spots of greater brilliance at irregular intervals along its length, like drops of water on a spider's web.

Poole continued walking towards the window, and the view expanded until at last he could see what lay below him. It was familiar enough: the whole continent of Europe, and much of northern Africa, just as he had seen them many times from space. So he was in orbit after all - probably an equatorial one, at a height of at least a thousand kilometres.

Indra was looking at him with a quizzical smile.

'Go closer to the window,' she said, very softly. 'So that you can look straight down. I hope you have a good head for heights.'

What a silly thing to say to an astronaut! Poole told himself as he moved forward. If I ever suffered from vertigo, I wouldn't be in this business...

The thought had barely passed through his mind when he cried 'My God!' and involuntarily stepped back from the window, Then, bracing himself, he dared to look again.

He was looking down on the distant Mediterranean from the face of a cylindrical tower, whose gently curving wall indicated a diameter of several kilometres. But that was nothing compared with its length, for it tapered away down, down, down - until it disappeared into the mist somewhere over Africa. He assumed that it continued all the way to the surface.

'How high are we?' he whispered.

'Two thousand kay. But now look upwards.'

This time, it was not such a shock: he had expected what he would see. The tower dwindled away until it became a glittering thread against the blackness of space, and he did not doubt that it continued all the way to the geostationary orbit, thirty-six thousand kilometres above the Equator. Such fantasies had been well known in Poole's day: he had never dreamed he would see the reality - and be living in it.

He pointed towards the distant thread reaching up from the eastern horizon.

'That must be another one.'

'Yes - the Asian Tower. We must look exactly the same to them.'

'How many are there?'

'Just four, equally spaced around the Equator. Africa, Asia, America, Pacifica. The last one's almost empty - only a few hundred levels completed. Nothing to see except water...'

Poole was still absorbing this stupendous concept when a disturbing thought occurred to him.

'There were already thousands of satellites, at all sorts of altitudes, in my time. How do you avoid collisions?'

Indra looked slightly embarrassed.

'You know - I never thought about that - it's not my field.' She paused for a moment, clearly searching her memory. Then her face brightened.

'I believe there was a big clean-up operation, centuries ago. There just aren't any satellites, below the stationary orbit.'

That made sense, Poole told himself. They wouldn't be needed - the four gigantic towers could provide all the facilities once provided by thousands of satellites and space-stations.

'And there have never been any accidents - any collisions with spaceships leaving earth, or re-entering the atmosphere?'

Indra looked at him with surprise.

'But they don't, any more,' She pointed to the ceiling. 'All the spaceports are where they should be - up there, on the outer ring. I believe it's four hundred years since the last rocket lifted off from the surface of the Earth.'

Poole was still digesting this when a trivial anomaly caught his attention. His training as an astronaut had made him alert to anything out of the ordinary: in space, that might be a matter of life or death.

The Sun was out of view, high overhead, but its rays streaming down through the great window painted a brilliant band of light on the floor underfoot. Cutting across that band at an angle was another, much fainter one, so that the frame of the window threw a double shadow.

Poole had to go almost down on his knees so that he could peer up at the sky. He had thought himself beyond surprise, but the spectacle of two suns left him momentarily speechless.

'What's that?' he gasped, when he had recovered his breath.

'Oh - haven't you been told? That's Lucifer.'

'Earth has another sun?'

'Well, it doesn't give us much heat, but it's put the Moon out of business... Before the Second Mission went there to look for you, that was the planet Jupiter.'

I knew I would have much to learn in this new world, Poole told himself. But just how much, I never dreamed.

5
Education

Poole was both astonished and delighted when the television set was wheeled into the room and positioned at the end of his bed. Delighted because he was suffering from mild information starvation - and astonished because it was a model which had been obsolete even in his own time.

'We've had to promise the Museum we'll give it back,' Matron informed him. 'And I expect you know how to use this,'

As he fondled the remote-control, Poole felt a wave of acute nostalgia sweep over him. As few other artefacts could, it brought back memories of his childhood, and the days when most television sets were too stupid to understand spoken commands.

'Thank you, Matron. What's the best news channel?'

She seemed puzzled by his question, then brightened.

'Oh - I see what you mean. But Professor Anderson thinks you're not quite ready yet. So Archives has put together a collection that will make you feel at home.'

Poole wondered briefly what the storage medium was in this day and age. He could still remember compact disks, and his eccentric old Uncle George had been the proud possessor of a collection of vintage videotapes. But surely that technological contest must have finished centuries ago - in the usual Darwinian way, with the survival of the fittest.

He had to admit that the selection was well done, by someone (Indra?) familiar with the early twenty-first century. There was nothing disturbing - no wars or violence, and very little contemporary business or politics, all of which would now be utterly irrelevant. There were some light comedies, sporting events (how did they know that he had been a keen tennis fan?), classical and pop music, and wildlife documentaries.

And whoever had put this collection together had a sense of humour, or they would not have included episodes from each Star Trek series. As a very small boy, Poole had met both Patrick Stewart and Leonard Nimoy: he wondered what they would have thought if they could have known the destiny of the child who had shyly asked for their autographs.

A depressing thought occurred to him, soon after he had started exploring - much of the time in fast-forward - these relics of the past. He had read somewhere that by the turn of the century - his century! - there were approximately fifty thousand television stations broadcasting simultaneously. If that figure had been maintained and it might well have increased - by now millions of millions of hours of TV programming must have gone on the air. So even the most hardened cynic would admit that there were probably at least a billion hours of worthwhile viewing... and millions that would pass the highest standards of excellence. How to find these few - well, few million - needles in so gigantic a haystack?

The thought was so overwhelming - indeed, so demoralizing - that after a week of increasingly aimless channel-surfing Poole asked for the set to be removed.

Perhaps fortunately, he had less and less time to himself during his waking hours, which were steadily growing longer as his strength came back.

There was no risk of boredom, thanks to the continual parade not only of serious researchers but also inquisitive - and presumably influential - citizens who had managed to filter past the palace guard established by Matron and Professor Anderson. Nevertheless, he was glad when, one day, the television set reappeared, he was beginning to suffer from withdrawal symptoms - and this time, he resolved to be more selective in his viewing.

The venerable antique was accompanied by Indra Wallace, smiling broadly.

'We've found something you must see, Frank. We think it will help you to adjust - anyway, we're sure you'll enjoy it.'

Poole had always found that remark a recipe for guaranteed boredom, and prepared for the worst. But the opening had him instantly hooked, taking him back to his old life as few other things could have done. At once he recognized one of the most famous voices of his age, and remembered that he had seen this

very programme before. Could it have been at its first transmission? No, he was only five then: must have been a repeat...

'Atlanta, 2000 December 31.'

'This is CNN International, five minutes from the dawn of the New Millennium, with all its unknown perils and promise...'

'But before we try to explore the future, let's look back a thousand years, and ask ourselves: could any persons living in Ad. 1000 even remotely imagine our world, or understand it, if they were magically transported across the centuries?'

'Almost the whole of the technology we take for granted was invented near the very end of our Millennium - the steam engine, electricity, telephones, radio, television, cinema, aviation, electronics. And, during a single lifetime, nuclear energy and space travel - what would the greatest minds of the past have made of these? How long could an Archimedes or a Leonardo have retained his sanity, if suddenly dumped into our world?'

'It's tempting to think that we would do better, if we were transported a thousand years hence. Surely the fundamental scientific discoveries have already been made, though there will be major improvements in technology, will there be any devices, anything as magical and incomprehensible to us as a pocket calculator or a video camera would have been to Isaac Newton?'

'Perhaps our age is indeed sundered from all those that have gone before. Telecommunications, the ability to record images and sounds once irrevocably lost, the conquest of the air and space - all these have created a civilization beyond the wildest fantasies of the past. And equally important, Copernicus, Newton, Darwin and Einstein have so changed our mode of thinking and our outlook on the universe that we might seem almost a new species to the most brilliant of our predecessors.'

'And will our successors, a thousand years from now, look back on us with the same pity with which we regard our ignorant, superstitious, disease-ridden, short-lived ancestors? We believe that we know the answers to questions that they could not even ask: but what surprises does the Third Millennium hold for us?'

'Well, here it comes -'

A great bell began to toll the strokes of midnight. The last vibration throbbed into silence...

'And that's the way it was - good-bye, wonderful and terrible twentieth century...'

Then the picture broke into a myriad fragments, and a new commentator took over, speaking with the accent which Poole could now easily understand, and which immediately brought him up to the present.

'Now, in the first minutes of the year three thousand and one, we can answer that question from the past...'

'Certainly, the people of 2001 who you were just watching would not feel as utterly overwhelmed in our age as someone from 1001 would have felt in theirs.

Many of our technological achievements they would have anticipated; indeed, they would have expected satellite cities, and colonies on the Moon and planets. They might even have been disappointed, because we are not yet immortal, and have sent probes only to the nearest stars...'

Abruptly, Indra switched off the recording.

'See the rest later, Frank: you're getting tired. But I hope it will help you to adjust.'

'Thank you, Indra. I'll have to sleep on it. But it's certainly proved one point.'

'What's that?'

'I should be grateful I'm not a thousand-and-oner, dropped into 2001. That would be too much of a quantum jump: I don't believe anyone could adjust to it. At least I know about electricity, and won't die of fright if a picture starts talking at me.'

I hope, Poole told himself, that confidence is justified. Someone once said that any sufficiently advanced technology is indistinguishable from magic. Will I meet magic in this new world - and be able to handle it?

6
Braincap

'I'm afraid you'll have to make an agonizing decision,' said Professor Anderson, with a smile that neutralized the exaggerated gravity of his words.

'I can take it, Doctor. Just give it to me straight.'

'Before you can be fitted with your Braincap, you have to be completely bald. So here's your choice. At the rate your hair grows, you'd have to be shaved at least once a month. Or you could have a permanent.'

'How's that done?'

'Laser scalp treatment. Kills the follicles at the root.'

'Hmm... is it reversible?'

'Yes, but that's messy and painful, and takes weeks.'

'Then I'll see how I like being hairless, before committing myself. I can't forget what happened to Samson.'

'Who?'

'Character in a famous old book. His girl-friend cut off his hair while he was sleeping. When he woke up, all his strength had gone.'

'Now I remember - pretty obvious medical symbolism!'

'Still, I wouldn't mind losing my beard. I'd be happy to stop shaving, once and for all.'

'I'll make the arrangements. And what kind of wig would you like?'

Poole laughed.

'I'm not particularly vain - think it would be a nuisance, and probably won't bother. Something else I can decide later.'

That everyone in this era was artificially bald was a surprising fact that Poole had been quite slow to discover; his first revelation had come when both his nurses removed their luxuriant tresses, without the slightest sign of embarrassment, just before several equally bald specialists arrived to give him a series of micro-biological checks. He had never been surrounded by so many hairless people, and his initial guess was that this was the latest step in the medical profession's endless war against germs.

Like many of his guesses, it was completely wrong, and when he discovered the true reason he amused himself by seeing how often he would have been sure, had he not known in advance, that his visitors' hair was not their own. The answer was: seldom with men, never with women; this was obviously the great age of the wig-maker.

Professor Anderson wasted no time: that afternoon the nurses smeared some evil-smelling cream over Poole's head, and when he looked into the mirror an hour later he did not recognize himself. Well, he thought, perhaps a wig would be a good idea, after all...

The Braincap fitting took somewhat longer. First a mould had to be made, which required him to sit motionless for a few minutes until the plaster set. He fully expected to be told that his head was the wrong shape when his nurses - giggling most unprofessionally - had a hard time extricating him. 'Ouch that hurt!' he complained.

Next came the skull-cap itself, a metal helmet that fitted snugly almost down to the ears, and triggered a nostalgic thought - wish my Jewish friends could see me now! After a few minutes, it was so comfortable that he was unaware of its presence.

Now he was ready for the installation - a process which, he realized with something akin to awe, had been the Rite of Passage for almost all the human race for more than half a millennium.

'There's no need to close your eyes,' said the technician, who had been introduced by the pretentious title of 'Brain Engineer' - almost always shortened to 'Brainman' in popular usage. 'When Setup begins, all your inputs will be taken over. Even if your eyes are open, you won't see anything.'

I wonder if everyone feels as nervous as this, Poole asked himself. Is this the last moment I'll be in control of my own mind? Still, I've learned to trust the technology of this age; up to now, it hasn't let me down. Of course, as the old saying goes, there's always a first time...

As he had been promised, he had felt nothing except a gentle tickling as the myriad of nanowires wormed their way through his scalp. All his senses were

still perfectly normal; when he scanned his familiar room, everything was exactly where it should be.

The Brainman - wearing his own skull-cap, wired, like Poole's, to a piece of equipment that could easily have been mistaken for a twentieth-century laptop computer - gave him a reassuring smile.

'Ready?' he asked.

There were times when the old cliche´s were the best ones.

'Ready as I'll ever be,' Poole answered.

Slowly, the light faded - or seemed to. A great silence descended, and even the gentle gravity of the Tower relinquished its hold upon him. He was an embryo, floating in a featureless void, though not in complete darkness. He had known such a barely visible, near ultra-violet tenebrosity, on the very edge of night, only once in his life when he had descended further than was altogether wise down the face of a sheer cliff at the outer edge of the Great Barrier Reef. Looking down into hundreds of metres of crystalline emptiness, he had felt such a sense of disorientation that he experienced a brief moment of panic, and had almost triggered his buoyancy unit before regaining control. Needless to say, he had never mentioned the incident to the Space Agency physicians...

From a great distance a voice spoke out of the immense void that now seemed to surround him. But it did not reach him through his ears: it sounded softly in the echoing labyrinths of his brain.

'Calibration starting. From time to time you will be asked questions - you can answer mentally, but it may help to vocalize. Do you understand?'

'Yes,' Poole replied, wondering if his lips were indeed moving. There was no way that he could tell.

Something was appearing in the void - a grid of thin lines, like a huge sheet of graph paper. It extended up and down, right and left, to the limits of his vision. He tried to move his head, but the image refused to change.

Numbers started to flicker across the grid, too fast for him to read - but presumably some circuit was recording them. Poole could not help smiling (did his cheeks move?) at the familiarity of it all. This was just like the computer-driven eye examination that any oculist of his age would give a client.

The grid vanished, to be replaced by smooth sheets of colour filling his entire field of view. In a few seconds, they flashed from one end of the spectrum to the other. 'Could have told you that,' Poole muttered silently. 'My colour vision's perfect. Next for hearing, I suppose.'

He was quite correct. A faint, drumming sound accelerated until it became the lowest of audible Cs, then raced up the musical scale until it disappeared beyond the range of human hearing, into bat and dolphin territory.

That was the last of the simple, straightforward tests. He was briefly assailed by scents and flavours, most of them pleasant but some quite the reverse. Then he became, or so it seemed, a puppet on an invisible strig.

He presumed that his neuromuscular control was being tested, and hoped that there were no external manifestations, if there were, he would probably look like someone in the terminal stages of St Vitus's Dance. And for one moment he even had a violent erection, but was unable to give it a reality check before he fell into a dreamless sleep.

Or did he only dream that he slept? He had no idea how much time had elapsed before he awoke. The helmet had already gone, together with the Brainman and his equipment.

'Everything went fine,' beamed Matron. 'It will take a few hours to check that there are no anomalies. If your reading's KO - I mean OK - you'll have your Braincap tomorrow.'

Poole appreciated the efforts of his entourage to learn archaic English, but he could not help wishing that Matron had not made that unfortunate slip-of-the-tongue.

When the time came for the final filling, Poole felt almost like a boy again, about to unwrap some wonderful new toy under the Christmas free.

'You won't have to go through all that setting-up again,' the Brainman assured him. 'Download will start immediately. I'll give you a five-minute demo. Just relax and enjoy.'

Gentle, soothing music washed over him; though it was something very familiar, from his own time, he could not identify it. There was a mist before his eyes, which parted as he walked towards it...

Yes, he was walking! The illusion was utterly convincing; he could feel the impact of his feet on the ground, and now that the music had stopped he could hear a gentle wind blowing through the great trees that appeared to surround him. He recognized them as Californian redwoods, and hoped that they still existed in reality, somewhere on Earth.

He was moving at a brisk pace - too fast for comfort, as if time was slightly accelerated so he could cover as much ground as possible. Yet he was not conscious of any effort; he felt he was a guest in someone else's body. The sensation was enhanced by the fact that he had no control over his movements. When he attempted to stop, or to change direction, nothing happened. He was going along for the ride.

It did not matter; he was enjoying the novel experience - and could appreciate how addictive it could become. The 'dream machines' that many scientists of his own century had anticipated - often with alarm - were now part of everyday life. Poole wondered how Mankind had managed to survive: he had been told that much of it had not. Millions had been brain-burned, and had dropped out of life.

Of course, he would be immune to such temptations! He would use this marvellous tool to learn more about the world of the Fourth Millennium, and to acquire in minutes new skills that would otherwise take years to master. Well - he might, just occasionally, use the Braincap purely for fun...

He had come to the edge of the forest, and was looking out across a wide river. Without hesitation, he walked into it, and felt no alarm as the water rose over his head. It did seem a little strange that he could continue

breathing naturally, but he thought it much more remarkable that he could see perfectly in a medium where the unaided human eye could not focus. He could count every scale on the magnificent trout that went swimming past, apparently oblivious to this strange intruder...

Then, a mermaid- Well he had always wanted to meet one, but he had assumed that they were marine creatures. Perhaps they occasionally came upstream - like salmon, to have their babies? She was gone before he could question her, to confirm or deny this revolutionary theory.

The river ended in a translucent wall; he stepped through it on to the face of a desert, beneath a blazing sun. Its heat burned him uncomfortably - yet he was able to look directly into its noonday fury. He could even see, with unnatural clarity, an archipelago of sunspots near one limb. And - this was surely impossible - there was the tenuous glory of the corona, quite invisible except during total eclipse, reaching out like a swan's wings on either side of the Sun.

Everything faded to black: the haunting music returned, and with it the blissful coolness of his familiar room. He opened his eyes (had they ever been closed?) and found an expectant audience waiting for his reaction.

'Wonderful!' he breathed, almost reverently. 'Some of it seemed - well, realer than real!'

Then his engineer's curiosity, never far from the surface, started nagging him.

'Even that short demo must have contained an enormous amount of information. How's it stored?'

'In these tablets - the same your audio-visual system uses, but with much greater capacity.'

The Brainman handed Poole a small square, apparently made of glass, silvered on one surface; it was almost the same size as the computer diskettes of his youth, but twice the thickness. As Poole tilted it back and forth, trying to see into its transparent interior, there were occasional rainbow-hued flashes, but that was all.

He was holding, he realized, the end product of more than a thousand years of electro-optical technology - as well as other technologies unborn in his era. And it was not surprising that, superficially, it resembled closely the devices he had known. There was a convenient shape and size for most of the common objects of everyday life -knives and forks, books, hand-tools, furniture... and removable memories for computers.

'What's its capacity?' he asked. 'In my time, we were up to a terabyte in something this size. I'm sure you've done a lot better.'

'Not as much as you might imagine - there's a limit, of course, set by the structure of matter. By the way, what was a terabyte? Afraid I've forgotten.'

'Shame on you! Kilo, mega, giga, tera... that's ten to the twelfth bytes. Then the petabyte - ten to the fifteenth - that's as far as I ever got.'

'That's about where we start. It's enough to record everything any person can experience during one lifetime.'

It was an astonishing thought, yet it should not have been so surprising. The kilogram of jelly inside the human skull was not much larger than the tablet Poole was holding in his hand, and it could not possibly be as efficient a storage device - it had so many other duties to deal with.

'And that's not all,' the Brainman continued. 'With some data compression, it could store not only the memories - but the actual person.'

'And reproduce them again?'

'Of course; straightforward job of nanoassembly.'

So I'd heard, Poole told himself - but I never really believed it.

Back in his century, it seemed wonderful enough that the entire lifework of a great artist could be stored on a single small disk. And now, something no larger could hold - the artist as well.

7
Debriefing

'I'm delighted,' said Poole, 'to know that the Smithsonian still exists, after all these centuries.'

'You probably wouldn't recognize it,' said the visitor who had introduced himself as Dr Alistair Kim, Director of Astronautics. 'Especially as it's now scattered over the Solar System - the main off-Earth collections are on Mars and the Moon, and many of the exhibits that legally belong to us are still heading for the stars. Some day we'll catch up with them and bring them home. We're particularly anxious to get our hands on Pioneer 10 - the first manmade object to escape from the Solar System.'

'I believe I was on the verge of doing that, when they located me.'

'Lucky for you - and for us. You may be able to throw light on many things we don't know.'

'Frankly, I doubt it - but I'll do my best. I don't remember a thing after that runaway space-pod charged me. Though I still find it hard to believe, I've been told that Hal was responsible.'

'That's true, but it's a complicated story. Everything we've been able to learn is in this recording - about twenty hours, but you can probably Fast most of it.'

'You know, of course, that Dave Bowman went out in the Number 2 Pod to rescue you - but was then locked outside the ship because Hal refused to open the pod-bay doors.'

'Why, for God's sake?'

Dr Kim winced slightly. It was not the first time Poole had noticed such a reaction.

(Must watch my language, he thought. 'God' seems to be a dirty word in this culture - must ask Indra about it.)

'There was a major programming error in Hal's instructions - he'd been given control of aspects of the mission you and Bowman didn't know about, it's all in the recording...

'Anyway, he also cut off the life-support systems to the three hybernauts - the Alpha Crew - and Bowman had to jettison their bodies as well.'

(So Dave and I were the Beta Crew - something else I didn't know...)

'What happened to them?' Poole asked. 'Couldn't they have been rescued, just as I was?'

'I'm afraid not: we've looked into it, of course. Bowman ejected them several hours after he'd taken back control from Hal, so their orbits were slightly different from yours. Just enough for them to burn up in Jupiter - while you skimmed by, and got a gravity boost that would have taken you to the Orion Nebula in a few thousand more years...'

'Doing everything on manual override - really a fantastic performance! - Bowman managed to get Discovery into orbit round Jupiter. And there he encountered what the Second Expedition called Big Brother - an apparent twin of the Tycho Monolith, but hundreds of times larger.'

'And that's where we lost him. He left Discovery in the remaining space-pod, and made a rendezvous with Big Brother. For almost a thousand years, we've been haunted by his last message: "By Deus - it's full of stars!"

(Here we go again! Poole told himself. No way Dave could have said that... Must have been 'My God - it's full of stars!')

'Apparently the pod was drawn into the Monolith by some kind of inertial field, because it - and presumably Bowman - survived an acceleration which should have crushed them instantly. And that was the last information anyone had, for almost ten years, until the joint US-Russian Leonov mission...'

'Which made a rendezvous with the abandoned Discovery so that Dr Chandra could go aboard and reactivate Hal. Yes, I know that.'

Dr Kim looked slightly embarrassed.

'Sorry - I wasn't sure how much you'd been told already Anyway, that's when even stranger things started to happen.'

'Apparently the arrival of Leonov triggered something inside Big Brother. If we did not have these recordings, no one would have believed what happened. Let me show you... here's Dr Heywood Floyd keeping the midnight watch aboard Discovery, after power had been restored. Of course you'll recognize everything.'

(Indeed I do: and how strange to see the long-dead Heywood Floyd, sitting in my old seat with Hal's unblinking red eye surveying everything in sight. And even stranger to think that Hal and I have both shared the same experience of resurrection from the dead...)

A message was coining up on one of the monitors, and Floyd answered lazily, 'OK, Hal. Who is calling?'

NO IDENTIFICATION.

Floyd looked slightly annoyed.

'Very well. Please give me the message.'

IT IS DANGEROUS TO REMAIN HERE. YOU MUST LEAVE WITHIN FIFTEEN DAYS.

'That is absolutely impossible. Our launch window does not open until twenty-six days from now. We do not have sufficient propellant for an earlier departure.'

I AM AWARE OF THESE FACTS. NEVERTHELESS YOU MUST LEAVE WITHIN FWFEEN DAYS.

'I cannot take this warning seriously unless I know its origin... who is speaking to me?'

I WAS DAVID BOWMAN. IT IS IMPORTANT THAT YOU BELIEVE ME. LOOK BEHIND YOU.

Heywood Floyd slowly turned in his swivel chair, away from the banked panels and switches of the computer display, towards the Velcro-covered catwalk behind.

('Watch this carefully,' said Dr Kim.

As if I needed telling, thought Poole...)

The zero-gravity environment of Discovery's observation deck was much dustier than he remembered it: he guessed that the air-filtration plant had not yet been brought on line. The parallel rays of the distant yet still brilliant Sun, streaming through the great windows, lit up a myriad of dancing motes in a classic display of Brownian movement.

And now something strange was happening to these particles of dust; some force seemed to be marshalling them, herding them away from a central point yet bringing others towards it, until they all met on the surface of a hollow sphere. That sphere, about a metre across, hovered in the air for a moment like a giant soap bubble. Then it elongated into an ellipsoid, whose surface began to pucker, to form folds and indentations. Poole was not really surprised when it started to assume the shape of a man.

He had seen such figures, blown out of glass, in museums and science exibitions. But this dusty phantom did not even approximate anatomical accuracy; it was like a crude clay figurine, or one of the primitive works of art found in the recesses of Stone Age caves. Only the head was fashioned with care; and the face, beyond all shadow of doubt, was that of Commander David Bowman.

HELLO, DR FLOYD. NOW DO YOU BELIEVE ME?

The lips of the figure never moved: Poole realized that the voice - yes, certainly Bowman's voice - was actually coming from the speaker grille.

THIS IS VERY DIFFICULT FOR ME, AND I HAVE LIITLE TIME. I HAVE BEEN ALLOWED TO GIVE THIS WARNING. YOU HAVE ONLY FIFFEEN DAYS.

'Why - and what are you?'

But the ghostly figure was already fading, its grainy envelope beginning to dissolve back into the constituent particles of dust.

GOOD-BYE, DOCTOR FLOYD. WE CAN HAVE NO FURTHER CONTACT. BUT THERE MAY BE ONE MORE MESSAGE, IF ALL GOES WELL.

As the image dissolved, Poole could not help smiling at that old Space Age cliche´. 'If all goes well' - how many times he had heard that phrase intoned before a mission!

The phantom vanished: only the motes of dancing dust were left, resuming their random patterns in the air. With an effort of will, Poole came back to the present.

'Well, Commander - what do you think of that?' asked Kim.

Poole was still shaken, and it was several seconds before he could reply.

'The face and the voice were Bowman's - I'd swear to that. But what was it?'

'That's what we're still arguing about. Call it a hologram, a projection - of course, there are plenty of ways it could be faked if anyone wanted to - but not in those circumstances! And then, of course, there's what happened next.'

'Lucifer?'

'Yes. Thanks to that warning, the Leonov had just sufficient time to get away before Jupiter detonated.'

'So whatever it was, the Bowman-thing was friendly and trying to help.'

'Presumably. And it may have been responsible for that "one more message" we did receive - it was sent only minutes before the detonation. Another waning.'

Dr Kim brought the screen to life once more. It showed plain text: ALL THESE WORLDS ARE YOURS EXCEPT EUROPA. ATTEMPT NO LANDINGS THERE. The same message was repeated about a hundred times, then the letters became garbled.

'And we never have tried to land there?' asked Poole.

'Only once, by accident, thirty-six years later - when the USSS Galaxy was hijacked and forced down there, and her sister ship Universe had to go to the rescue. It's all here -with what little our robot monitors have told us about the Europans.'

'I'm anxious to see them.'

'They're amphibious, and come in all shapes and sizes. As soon as Lucifer started melting the ice that covered theirt whole world, they began to emerge

from the sea. Since then, they've developed at a speed that seems biologically impossible.'

'From what I remember about Europa, weren't there lots of cracks in the ice? Perhaps they'd already started crawling through and having a look round.'

'That's a widely accepted theory. But there's another, much more speculative, one. The Monolith may have been involved, in ways we don't yet understand. What triggered that line of thought was the discovery of TMA ZERO, right here on Earth, almost five hundred years after your time. I suppose you've been told about that?'

'Only vaguely - there's been so much to catch up with! I did think the name was ridiculous - since it wasn't a magnetic anomaly - and it was in Africa, not Tycho!'

'You're quite right, of course, but we're stuck with the name. And the more we learn about the Monoliths, the more the puzzle deepens. Especially as they're still the only real evidence for advanced technology beyond the Earth.'

'That's surprised me. I should have thought that by this lime we'd have picked up radio signals from somewhere. The astronomers started searching when I was a boy!'

'Well, there is one hint - and it's so terrifying that we don't like to talk about it. Have you heard of Nova Scorpio?'

'I don't believe so.'

'Stars go nova all the time, of course - and this wasn't a particularly impressive one. But before it blew up, N Scorp was known to have several planets.'

'Inhabited?'

'Absolutely no way of telling; radio searches had picked up nothing. And here's the nightmare...'

'Luckily, the automatic Nova Patrol caught the event at the very beginning. And it didn't start at the star. One of the planets detonated first, and then triggered its sun.'

'My Gah... sorry, go on.'

'You see the point. It's impossible for a planet to go nova - except in one way.'

'I once read a sick joke in a science-fiction novel - "supernovae are industrial accidents".'

'It wasn't a supernova - but that may be no joke. The most widely accepted theory is that someone else had been tapping vacuum energy - and had lost control.'

'Or it could have been a war.'

'Just as bad; we'll probably never know. But as our own civilization depends on the same energy source, you can understand why N Scorp sometimes gives us nightmares.'

'And we only had melting nuclear reactors to worry about!'

'Not any longer, thank Deus. But I really wanted to tell you more about TMA ZERO's discovery, because it marked a turning point in human history.'

'Finding TMA ONE on the Moon was a big enough shock, but five hundred years later there was a worse one. And it was much nearer home - in every sense of the word. Down there in Africa.'

8
Return to Olduvai

The Leakeys, Dr Stephen Del Marco often told himself, would never have recognized this place, even though it's barely a dozen kilometres from where Louis and Mary, five centuries ago, dug up the bones of our first ancestors. Global warming, and the Little Ice Age (truncated by miracles of heroic technology) had transformed the landscape, and completely altered its biota. Oaks and pine trees were still fighting it out, to see which would survive the changes in climatic fortune.

And it was hard to believe that, by this year 2513, there was anything left in Olduvai undug by enthusiastic anthropologists. However, recent flash-floods - which were not supposed to happen any more - had resculpted this area, and cut away several metres of topsoil. Del Marco had taken advantage of the opportunity: and there, at the limit of the deep-scan, was something he could not quite believe.

It had taken more than a year of slow and careful excavation to reach that ghostly image, and to learn that the reality was stranger than anything he had dared to imagine. Robot digging machines had swiftly removed the first few metres, then the traditional slave-crews of graduate students had taken over. They had been helped - or hindered - by a team of four kongs, who Del Marco considered more trouble than they were worth. However, the students adored the genetically-enhanced gorillas, whom they treated like retarded but much-loved children. It was rumoured that the relationships were not always completely Platonic.

For the last few metres, however, everything was the work of human hands, usually wielding toothbrushes - soft-bristled at that. And now it was finished: Howard Carter, seeing the first glint of gold in Tutankhamen's tomb, had never uncovered such a treasure as this. From this moment onwards, Del Marco knew, human beliefs and philosophies would be irrevocably changed.

The Monolith appeared to be the exact twin of that discovered on the Moon five centuries earlier: even the excavation surrounding it was almost identical in size. And like TMA ONE, it was totally non-reflective, absorbing with equal indifference the fierce glare of the African Sun and the pale gleam of Lucifer.

As he led his colleagues - the directors of the world's half-dozen most famous museums, three eminent anthropologists, the heads of two media empires - down into the pit, Del Marco wondered if such a distinguished group of men and women had ever been so silent, for so long. But that was the effect that this ebon rectangle had on all visitors, as they realized the implications of the thousands of artefacts that surrounded it.

For here was an archaeologist's treasure-trove - crudely-fashioned flint tools, countless bones - some animal, some human - and almost all arranged in careful patterns. For centuries - no, millennia - these pitiful gifts had been brought here, by creatures with only the first glimmer of intelligence, as tribute to a marvel beyond their understanding.

And beyond ours, Del Marco had often thought. Yet of two things he was certain, though he doubted if proof would ever be possible.

This was where - in time and space - the human species had really begun.

And this Monolith was the very first of all its multitudinous gods.

9
Skyland

'There were mice in my bedroom last night,' Poole complained, only half seriously. 'Is there any chance you could find me a cat?'

Dr Wallace looked puzzled, then started to laugh.

'You must have heard one of the cleaning microts - I'll get the programming checked so they don't disturb you. Try not to step on one if you catch it at work; if you do, it will call for help, and all its friends will come to pick up the pieces.'

So much to learn - so little time! No, that wasn't true, Poole reminded himself. He might well have a century ahead of him, thanks to the medical science of this age. The thought was already beginning to fill him with apprehension rather than pleasure.

At least he was now able to follow most conversations easily, and had learned to pronounce words so that Indra was not the only person who could understand him. He was very glad that Anglish was now the world language, though French, Russian and Mandarin still flourished.

'I've another problem, Indra - and I guess you're the only person who can help. When I say "God", why do people look embarrassed?'

Indra did not look at all embarrassed; in fact, she laughed.

'That's a very complicated story. I wish my old friend Dr Khan was here to explain it to you - but he's on Ganymede, curing any remaining True Believers he can find there. When all the old religions were discredited - let me tell you about Pope Pius XX sometime - one of the greatest men in history! - we still

needed a word for the Prime Cause, or the Creator of the Universe - if there is one...'

'There were lots of suggestions - Deo - Theo - Jove - Brahma - they were all tried, and some of them are still around - especially Einstein's favourite, "The Old One". But Deus seems to be the fashion nowadays.'

'I'll try to remember; but it still seems silly to me.'

'You'll get used to it: I'll teach you some other reasonably polite expletives, to use when you want to express your feelings...'

'You said that all the old religions have been discredited. So what do people believe nowadays?'

'As little as possible. We're all either Deists or Theists.'

'You've lost me. Definitions, please.'

'They were slightly different in your time, but here are the latest versions. Theists believe there's not more than one God; Deists that there is not less than one God.'

'I'm afraid the distinction's too subtle for me.'

'Not for everyone; you'd be amazed at the bitter controversies it's aroused. Five centuries ago, someone used what's known as surreal mathematics to prove there's an infinite number of grades between Theists and Deists. Of course, like most dabblers with infinity, he went insane. By the way, the best-known Deists were Americans - Washington, Franklin, Jefferson.'

'A little before my time - though you'd be surprised how many people don't realize it.'

'Now I've some good news. Joe - Prof. Anderson - has finally given his - what was the phrase? - OK. You're fit enough to go for a little trip upstairs... to the Lunar Level.'

'Wonderful. How far is that?'

'Oh, about twelve thousand kilometres.'

'Twelve thousand! That will take hours!'

Indra looked surprised at his remark: then she smiled.

'Not as long as you think. No - we don't have a Star Trek Transporter yet - though I believe they're still working on it! But you'll need new clothes, and someone to show you how to wear them. And to help you with the hundreds of little everyday jobs that can waste so much time. So we've taken the liberty of arranging a human personal assistant for you Come in, Danil.'

Danil was a small, light-brown man in his mid-thirties, who surprised Poole by not giving him the usual palm-top salute, with its automatic exchange of information.

Indeed, it soon appeared that Danil did not possess an Ident: whenever it was needed, he produced a small rectangle of plastic that apparently served the same purpose as the twenty-first century's 'smart cards'.

'Danil will also be your guide and what was that word? - I can never remember - rhymes with "ballet". He's been specially trained for the job. I'm sure you'll find him completely satisfactory.'

Though Poole appreciated this gesture, it made him feel a little uncomfortable. A valet, indeed! He could not recall ever meeting one; in his time, they were already a rare and endangered species. He began to feel like a character from an early-twentieth-century English novel.

'You have a choice,' said Indra, 'though I know which one you'll take. We can go up on an external elevator, and admire the view - or an interior one, and enjoy a meal and some light entertainment.'

'I can't imagine anyone wanting to stay inside.'

'You'd be surprised. It's too vertiginous for some people - especially visitors from down below. Even mountain climbers who say they've got a head for heights may start to turn green - when the heights are measured in thousands of kilometres, instead of metres.'

'I'll risk it,' Poole answered with a smile. 'I've been higher.'

When they had passed through a double set of airlocks in the exterior wall of the Tower (was it imagination, or did he feel a curious sense of disorientation then?) they entered what might have been the auditorium of a very small theatre. Rows of ten seats were banked up in five tiers: they all faced towards one of the huge picture windows which Poole still found disconcerting, as he could never quite forget the hundreds of tons of air pressure, striving to blast it out into space.

The dozen or so other passengers, who had probably never given the matter any thought, seemed perfectly at ease. They all smiled as they recognized him, nodded politely, then turned away to admire the view.

'Welcome to Skylounge,' said the inevitable autovoice. 'Ascent begins in five minutes. You will find refreshments and toilets on the lower floor.'

Just how long will this trip last? Poole wondered. We're going to travel over twenty thousand klicks, there and back: this will be like no elevator ride I've ever known on Earth...

While he was waiting for the ascent to begin, he enjoyed the stunning panorama laid out two thousand kilometres below. It was winter in the northern hemisphere, but the climate had indeed changed drastically, for there was little snow south of the Arctic Circle.

Europe was almost cloud-free, and there was so much detail that the eye was overwhelmed. One by one he identified the great cities whose names had echoed down the centuries; they had been shrinking even in his time, as the communications revolution changed the face of the world, and had now dwindled still further. There were also some bodies of water in improbable places - the northern Sahara's Lake Saladin was almost a small sea.

Poole was so engrossed by the view that he had forgotten the passage of time. Suddenly he realized that much more than five minutes had passed - yet the elevator was still stationary. Had something gone wrong - or were they waiting for late arrivals?

And then he noticed something so extraordinary that at first he refused to believe the evidence of his eyes. The panorama had expanded, as if he had already risen hundreds of kilometres! Even as he watched, he noticed new features of the planet below creeping into the frame of the window.

Then Poole laughed, as the obvious explanation occurred to him.

'You could have fooled me, Indra! I thought this was real - not a video projection!'

Indra looked back at him with a quizzical smile.

'Think again, Frank. We started to move about ten minutes ago. By now we must be climbing at, oh - at least a thousand kilometres an hour. Though I'm told these elevators can reach a hundred gee at maximum acceleration, we won't touch more than ten, on this short run.'

'That's impossible! Six is the maximum they ever gave me in the centrifuge, and I didn't enjoy weighing half a ton. I know we haven't moved since we stepped inside.'

Poole had raised his voice slightly, and suddenly became aware that the other passengers were pretending not to notice.

'I don't understand how it's done, Frank, but it's called an inertial field. Or sometimes a Sharp one - the "S" stands for a famous Russian scientist, Sakharov - I don't know who the others were.'

Slowly, understanding dawned in Poole's mind - and also a sense of awe-struck wonder. Here indeed was a 'technology indistinguishable from magic'.

'Some of my friends used to dream of "space drives" - energy fields that could replace rockets, and allow movement without any feeling of acceleration, Most of us thought they were crazy - but it seems they were right! I can still hardly believe it... and unless I'm mistaken, we're starting to lose weight.'

'Yes - it's adjusting to the lunar value. When we step out, you'll feel we're on the Moon. But for goodness' sake, Frank - forget you're an engineer, and simply enjoy the view.'

It was good advice, but even as he watched the whole of Africa, Europe and much of Asia flow into his field of vision, Poole could not tear his mind away from this astonishing revelation. Yet he should not have been wholly surprised: he knew that there had been major breakthroughs in space propulsion systems since his time, but had not realized that they would have such dramatic applications to everyday life - if that term could be applied to existence in a thirty-six-thousand-kilometre-high skyscraper.

And the age of the rocket must have been over, centuries ago. All his knowledge of propellant systems and combustion chambers, ion thrusters and fusion reactors, was totally obsolete. Of course, that no longer mattered - but

he understood the sadness that the skipper of a windjammer must have felt, when sail gave way to steam.

His mood changed abruptly, and he could not help smiling, when the robovoice announced, 'Arriving in two minutes. Please make sure that you do not leave any of your personal belongings behind.'

How often he had heard that announcement, on some commercial flight? He looked at his watch, and was surprised to see that they had been ascending for less than half an hour So that meant an average speed of at least twenty thousand kilometres an hour, yet they might never have moved. What was even stranger - for the last ten minutes or more they must actually have been decelerating so rapidly that by rights they should all have been standing on the roof, heads pointing towards Earth!

The doors opened silently, and as Poole stepped out he again felt the slight disorientation he had noticed on entering the elevator lounge. This time, however, he knew what it meant: he was moving through the transition zone where the inertial field overlapped with gravity - at this level, equal to the Moon's.

Indra and Danil followed him, walking carefully now at a third of their customary weight, as they went forward to meet the next of the day's wonders.

Though the view of the receding Earth had been awesome, even for an astronaut, there was nothing unexpected or surprising about it. But who would have imagined a gigantic chamber, apparently occupying the entire width of the Tower, so that the far wall was more than five kilometres away? Perhaps by this time there were larger enclosed volumes on the Moon and Mars, but this must surely be one of the largest in space itself.

They were standing on a viewing platform, fifty metres up on the outer wall, looking across an astonishingly varied panorama. Obviously, an attempt had been made to reproduce a whole range of terrestrial biomes. Immediately beneath them was a group of slender trees which Poole could not at first identify: then he realized that they were oaks, adapted to one-sixth of their normal gravity. What, he wondered, would palm frees look like here? Giant reeds, probably...

In the middle-distance there was a small lake, fed by a river that meandered across a grassy plain, then disappeared into something that looked like a single gigantic banyan tree. What was the source of the water? Poole had become aware of a faint drumming sound, and as he swept his gaze along the gently curving wall, he discovered a miniature Niagara, with a perfect rainbow hovering in the spray above it.

He could have stood here for hours, admiring the view and still not exhausting all the wonders of this complex and brilliantly contrived simulation of the planet below. As it spread out into new and hostile environments, perhaps the human race felt an ever-increasing need to remember its origins. Of course, even in his own time every city had its parks as - usually feeble - reminders of Nature. The same impulse must be acting here, on a much grander scale. Central Park, Africa Tower!

'Let's go down,' said Indra. 'There's so much to see, and I don't come here as often as I'd like.'

Followed by the silent but ever-present Danil, who always seemed to know when he was needed but otherwise kept out of the way, they began a leisurely

exploration of this oasis in space. Though walking was almost effortless in this low gravity, from time to time they took advantage of a small monorail, and stopped once for refreshments at a cafe´, cunningly concealed in the trunk of a redwood that must have been at least a quarter of a kilometre tall.

There were very few other people about - their fellow passengers had long since disappeared into the landscape - so it was as if they had all this wonderland to themselves.

Everything was so beautifully maintained, presumably by armies of robots, that from time to time Poole was reminded of a visit he had made to Disney World as a small boy. But this was even better: there were no crowds, and indeed very little reminder of the human race and its artefacts.

They were admiring a superb collection of orchids, some of enormous size, when Poole had one of the biggest shocks of his life. As they walked past a typical small gardener's shed, the door opened - and the gardener emerged.

Frank Poole had always prided himself on his self-control, and never imagined that as a full-grown adult he would give a cry of pure fright. But like every boy of his generation, he had seen all the 'Jurassic' movies - and he knew a raptor when he met one eye to eye.

'I'm terribly sorry,' said Indra, with obvious concern. 'I never thought of warning you.'

Poole's jangling nerves returned to normal. Of course, there could be no danger, in this perhaps too-well-ordered world: but still...!

The dinosaur returned his stare with apparent total disinterest, then doubled back into the shed and emerged again with a rake and a pair of garden shears, which it dropped into a bag hanging over one shoulder. It walked away from them with a bird-like gait, never looking back as it disappeared behind some ten-metre-high sunflowers.

'I should explain,' said Indra contritely. 'We like to use bio-organisms when we can, rather than robots - I suppose it's carbon chauvinism! Now, there are only a few animals that have any manual dexterity, and we've used them all at one time or another.'

'And here's a mystery that no one's been able to solve. You'd think that enhanced herbivores like orangutans and gorillas would be good at this sort of work. Well, they're not; they don't have the patience for it.'

'Yet carnivores like our friend here are excellent, and easily trained. What's more - here's another paradox! -after they've been modified they're docile and good-natured. Of course, there's almost a thousand years of genetic engineering behind them, and look what primitive man did to the wolf, merely by trial and error!'

Indra laughed and continued: 'You may not believe this, Frank, but they also make good baby-sitters - children love them! There's a five-hundred-year-old joke: "Would you trust your kids to a dinosaur?" "What - and risk injuring it?"'

Poole joined in the laughter, partly in shame-faced reaction to his own fright. To change the subject, he asked Indra the question that was still worrying him.

'All this,' he said, 'it's wonderful - but why go to so much trouble, when anyone in the Tower can reach the real thing, just as quickly?'

Indra looked at him thoughtfully, weighing her words. 'That's not quite true. It's uncomfortable - even dangerous - for anyone who lives above the half-gee level to go down to Earth, even in a hoverchair. So it has to be this -or, as you used to say, Virtual Reality.'

(Now I begin to understand, Poole told himself bleakly. That explains Anderson's evasiveness, and all the tests he's been doing to see if I've regained my strength. I've come all the way back from Jupiter, to within two thousand kilometres of Earth - but I may never again walk on the surface of my home planet. I'm not sure how I will be able to handle this...)

10
Homage to Icarus

His depression quickly passed: there was so much to do and see. A thousand lifetimes would not have been enough, and the problem was to choose which of the myriad distractions this age could offer. He tried, not always successfully, to avoid the trivia, and to concentrate on the things that mattered - notably his education.

The Braincap - and the book-sized player that went with it, inevitably called the Brainbox - was of enormous value here. He soon had a small library of 'instant knowledge' tablets, each containing all the material needed for a college degree. When he slipped one of these into the Brainbox, and gave it the speed and intensity adjustments that most suited him, there would be a flash of light, followed by a period of unconsciousness that might last as long as an hour. When he awoke, it seemed that new areas of his mind had been opened up, though he only knew they were there when he searched for them. It was almost as if he was the owner of a library who had suddenly discovered shelves of books he did not know he possessed.

To a large extent, he was the master of his own time. Out of a sense of duty - and gratitude - he acceded to as many requests as he could from scientists, historians, writers and artists working in media that were often incomprehensible to him. He also had countless invitations from other citizens of the four Towers, virtually all of which he was compelled to turn down.

Most tempting - and most hard to resist - were those that came from the beautiful planet spread out below. 'Of course,' Professor Anderson had told him, 'you'd survive if you went down for short time with the right life-support system, but you wouldn't enjoy it. And it might weaken your neuromuscular system even further. It's never really recovered from that thousand-year sleep.'

His other guardian, Indra Wallace, protected him from unnecessary intrusions, and advised him which requests he should accept - and which he should politely refuse. By himself, he would never understand the socio-political structure of this incredibly complex culture, but he soon gathered that, although in theory all class distinctions had vanished, there were a few

thousand super-citizens. George Orwell had been right; some would always be more equal than others.

There had been times when, conditioned by his twentyfirst-century experience, Poole had wondered who was paying for all this hospitality - would he one day be presented with the equivalent of an enormous hotel bill? But Indra had quickly reassured him: he was a unique and priceless museum exhibit, so would never have to worry about such mundane considerations. Anything he wanted - within reason - would be made available to him: Poole wondered what the limits were, never imagining that one day he would attempt to discover them.

All the most important things in life happen by accident, and he had set his wall display browser on random scan, silent, when a striking image caught his attention.

'Stop scan! Sound up!' he shouted, with quite unnecessary loudness.

He recognized the music, but it was a few minutes before he identified it; the fact that his wall was filled with winged humans circling gracefully round each other undoubtedly helped. But Tchaikovsky would have been utterly astonished to see this performance of Swan Lake - with the dancers actually flying...

Poole watched, entranced, for several minutes, until he was fairly confident that this was reality, and not a simulation: even in his own day, one could never be quite certain. Presumably the ballet was being performed in one of the many low-gravity environments - a very large one, judging by some of the images. It might even be here in Africa Tower.

I want to try that, Poole decided. He had never quite forgiven the Space Agency for banning one of his greatest pleasures - delayed parachute formation jumping - even though he could see the Agency's point in not wanting to risk a valuable investment. The doctors had been quite unhappy about his earlier hang-gliding accident; fortunately his teenage bones had healed completely.

'Well,' he thought, 'there's no one to stop me now unless it's Prof. Anderson...'

To Poole's relief, the physician thought it an excellent idea, and he was also pleased to find that every one of the Towers had its own Aviary, up at the one-tenth-gee level.

Within a few days he was being measured for his wings, not in the least like the elegant versions worn by the performers of Swan Lake. Instead of feathers there was a flexible membrane, and when he grasped the hand-holds attached to the supporting ribs, Poole realized that he must look much more like a bat than a bird. However his 'Move over, Dracula!' was completely wasted on his instructor, who was apparently unacquainted with vampires.

For his first lessons he was restrained by a light harness, so that he did not move anywhere while he was taught the basic strokes - and, most important of all, learned control and stability. Like many acquired skills, it was not quite as easy as it looked.

He felt ridiculous in this safety-harness - how could anyone injure themselves at a tenth of a gravity! - and was glad that he needed only a few lessons; doubtless his astronaut training helped. He was, the Wingmaster told him, the best pupil he had ever taught: but perhaps he said that to all of them.

After a dozen free-flights in a chamber forty metres on a side, criss-crossed with various obstacles which he easily avoided, Poole was given the all-clear for his first solo - and felt nineteen years old again, about to take off in the Flagstaff Aero Club's antique Cessna.

The unexciting name 'The Aviary' had not prepared him for the venue of this maiden flight. Though it seemed even more enormous than the space holding the forests and gardens down at the lunar-gee level, it was almost the same size, since it too occupied an entire floor of the gently tapering Tower. A circular void, half a kilometre high and over four kilometres wide, it appeared truly enormous, as there were no features on which the eye could rest. Because the walls were a uniform pale blue, they contributed to the impression of infinite space.

Poole had not really believed the Wingmaster's boast, 'You can have any scenery you like', and intended to throw him what he was sure was an impossible challenge. But on this first flight, at the dizzy altitude of fifty metres, there were no visual distractions, Of course, a fall from the equivalent altitude of five metres in the ten-fold greater Earth gravity could break one's neck; however, even minor bruises were unlikely here, as the entire floor was covered with a network of flexible cables The whole chamber was a giant trampoline; one could, thought Poole, have a lot of fun here - even without wings.

With firm, downward strokes, Poole lifted himself into the air. In almost no time, it seemed that he was a hundred metres in the air, and still rising.

'Slow down' said the Wingmaster, 'I can't keep up with you,'

Poole straightened out, then attempted a slow roll. He felt light-headed as well as light-bodied (less than ten kilograms!) and wondered if the concentration of oxygen had been increased.

This was wonderful - quite different from zero gravity, as it posed more of a physical challenge. The nearest thing to it was scuba diving: he wished there were birds here, to emulate the equally colourful coral fish who had so often accompanied him over tropical reefs.

One by one, the Wingmaster put him through a series of manoeuvres - rolls, loops, upside-down flying, hovering.

Finally he said: 'Nothing more I can teach you. Now let's enjoy the view.'

Just for a moment, Poole almost lost control - as he was probably expected to do. For, without the slightest warning, he was surrounded by snow-capped mountains, and was flying down a narrow pass, only metres from some unpleasantly jagged rocks.

Of course, this could not be real: those mountains were as insubstantial as clouds, and he could fly right through them if he wished. Nevertheless, he veered away from the cliff-face (there was an eagle's nest on one of its ledges,

holding two eggs which he felt he could touch if he came closer) and headed for more open space.

The mountains vanished; suddenly, it was night. And then the stars came out - not the miserable few thousand in the impoverished skies of Earth, but legions beyond counting. And not only stars, but the spiral whirlpools of distant galaxies, the teeming, close-packed sun-swarms of globular clusters.

There was no possible way this could be real, even if he had been magically transported to some world where such skies existed. For those galaxies were receding even as he watched; stars were fading, exploding, being born in stellar nurseries of glowing fire-mist. Every second, a million years must be passing...

The overwhelming spectacle disappeared as quickly as it had come: he was back in the empty sky, alone except for his instructor, in the featureless blue cylinder of the Aviary.

'I think that's enough for one day,' said the Wingmaster, hovering a few metres above Poole. 'What scenery would you like, the next time you come here?'

Poole did not hesitate. With a smile, he answered the question.

11
Here be Dragons

He would never have believed it possible, even with the technology of this day and age. How many terabytes - petabytes - was there a large enough word? - of information must have been accumulated over the centuries, and in what sort of storage medium? Better not think about it, and follow Indra's advice: 'Forget you're an engineer - and enjoy yourself.'

He was certainly enjoying himself now, though his pleasure was mixed with an almost overwhelming sense of nostalgia. For he was flying, or so it seemed, at an altitude of about two kilometres, above the spectacular and unforgotten landscape of his youth. Of course, the perspective was false, since the Aviary was only half a kilometre high, but the illusion was perfect.

He circled Meteor Crater, remembering how he had scrambled up its sides during his earlier astronaut training. How incredible that anyone could ever have doubted its origin, and the accuracy of its name! Yet well into the twentieth century, distinguished geologists had argued that it was volcanic: not until the coming of the Space Age was it - reluctantly - accepted that all planets were still under continual bombardment.

Poole was quite sure that his comfortable cruising speed was nearer twenty than two hundred kilometres an hour, yet he had been allowed to reach Flagstaff in less than fifteen minutes. And there were the whitely-gleaming domes of the Lowell Observatory, which he had visited so often as a boy, and whose friendly staff had undoubtedly been responsible for his choice of career. He had sometimes wondered what his profession might have been, had he not been born in Arizona, near the very spot where the most long-enduring and influential of Martian fantasies had been created. Perhaps it was imagination, but Poole

thought he could just see Lowell's unique tomb, close to the great telescope, which had fuelled his dreams.

From what year, and what season, had this image been captured? He guessed it had come from the spy satellites which had watched over the world of the early twenty-first century. It could not be much later than his own time, for the layout of the city was just as he remembered. Perhaps if he went low enough he would even see himself...

But he knew that was absurd; he had already discovered that this was the nearest he could get. If he flew any closer, the image would start to breakup, revealing its basic pixels. It was better to keep his distance, and not destroy the beautiful illusion.

And there - it was incredible! - was the little park where he had played with his junior and high-school friends. The City Fathers were always arguing about its maintenance, as the water supply became more and more critical. Well, at least it had survived to this time - whenever that might be.

And then another memory brought tears to his eyes. Along those narrow paths, whenever he could get home from Houston or the Moon, he had walked with his beloved Rhodesian Ridgeback, throwing sticks for him to retrieve, as man and dog had done from time immemorial.

Poole had hoped, with all his heart, that Rikki would still be there to greet him when he returned from Jupiter, and had left him in the care of his younger brother Martin. He almost lost control, and sank several metres before regaining stability, as he once more faced the bitter truth that both Rikki and Martin had been dust for centuries.

When he could see properly again, he noticed that the dark band of the Grand Canyon was just visible on the far horizon. He was debating whether to head for it - he was growing a little tired - when he became aware that he was not alone in the sky. Something else was approaching, and it was certainly not a human flyer. Although it was difficult to judge distances here, it seemed much too large for that.

Well, he thought, I'm not particularly surprised to meet a pterodactyl here - indeed, it's just the sort of thing I'd expect. I hope it's friendly - or that I can outfly it if it isn't. Oh, no!

A pterodactyl was not a bad guess: maybe eight points out of ten. What was approaching him now, with slow flaps of its great leathery wings, was a dragon straight out of Fairyland. And, to complete the picture, there was a beautiful lady riding on its back. At least, Poole assumed she was beautiful. The traditional image was rather spoiled by one trifling detail: much of her face was concealed by a large pair of aviator's goggles that might have come straight from the open cockpit of a World War I biplane.

Poole hovered in mid-air, like a swimmer treading water, until the oncoming monster came close enough for him to hear the flapping of its great wings. Even when it was less than twenty metres away, he could not decide whether it was a machine or a bio-construct: probably both.

And then he forgot about the dragon, for the rider removed her goggles.

The trouble with cliche´s, some philosopher remarked, probably with a yawn, is that they are so boringly true.

But 'love at first sight' is never boring.

Danil could provide no information, but then Poole had not expected any from him. His ubiquitous escort - he certainly would not pass muster as a classic valet - seemed so limited in his functions that Poole sometimes wondered if he was mentally handicapped, unlikely though that seemed. He understood the functioning of all the household appliances, carried out simple orders with speed and efficiency, and knew his way about the Tower. But that was all; it was impossible to have an intelligent conversation with him, and any polite queries about his family were met with a look of blank incomprehension. Poole had even wondered if he too was a bio-robot.

Indra, however, gave him the answer he needed right away.

'Oh, you've met the Dragon Lady!'

'Is that what you call her? What's her real name - and can you get me her Ident? We were hardly in a position to touch palms.'

'Of course - no problemo.'

'Where did you pick up that?'

Indra looked uncharacteristically confused.

'I've no idea - some old book or movie. Is it a good figure of speech?'

'Not if you're over fifteen.'

'I'll try to remember. Now tell me what happened - unless you want to make me jealous.'

They were now such good friends that they could discuss any subject with perfect frankness. Indeed, they had laughingly lamented their total lack of romantic interest in each other - though Indra had once commented, 'I guess that if we were both marooned on a desert asteroid, with no hope of rescue, we could come to some arrangement.'

'First, you tell me who she is.'

'Her name's Aurora McAuley; among many other things, she's President of the Society for Creative Anachronisms. And if you thought Draco was impressive, wait until you see some of their other - ah - creations. Like Moby Dick - and a whole zooful of dinosaurs Mother Nature never thought of.'

This is too good to be true, thought Poole.

I am the biggest anachronism on Planet Earth.

Frustration

Until now, he had almost forgotten that conversation with the Space Agency psychologist.

'You may be gone from Earth for at least three years. If you like, I can give you a harmless anaphrodisiac implant that will last out the mission. I promise we'll more than make it up, when you get home.'

'No thanks,' Poole had answered, trying to keep his face straight when he continued, 'I think I can handle it.'

Nevertheless, he had become suspicious after the third or fourth week - and so had Dave Bowman.

'I've noticed it too,' Dave said 'I bet those damn doctors put something in our diet...'

Whatever that something was - if indeed it had ever existed - it was certainly long past its shelf-life. Until now, Poole had been too busy to get involved in any emotional entanglements, and had politely turned down generous offers from several young (and not so young) ladies. He was not sure whether it was his physique or his fame that appealed to them: perhaps it was nothing more than simple curiosity about a man who, for all they knew, might be an ancestor from twenty or thirty generations in the past.

To Poole's delight, Mistress McAuley's Ident conveyed the information that she was currently between lovers, and he wasted no further time in contacting her. Within twenty-four hours he was pillion-riding, with his arms enjoyably around her waist. He had also learned why aviator's goggles were a good idea, for Draco was entirely robotic, and could easily cruise at a hundred klicks. Poole doubted if any real dragons had ever attained such speeds.

He was not surprised that the ever-changing landscapes below them were straight out of legend. Ali Baba had waved angrily at them, as they overtook his flying carpet, shouting 'Can't you see where you're going!' Yet he must be a long way from Baghdad, because the dreaming spires over which they now circled could only be Oxford.

Aurora confirmed his guess as she pointed down: 'That's the pub - the inn - where Lewis and Tolkien used to meet their friends, the Inklings. And look at the river - that boat just coming out from the bridge - do you see the two little girls and the clergyman in it?'

'Yes,' he shouted back against the gentle sussuration of Draco's slipstream. 'And I suppose one of them is Alice.'

Aurora turned and smiled at him over her shoulder: she seemed genuinely delighted.

'Quite correct: she's an accurate replica, based on the Reverend's photos. I was afraid you wouldn't know. So many people stopped reading soon after your time.'

Poole felt a glow of satisfaction.

I believe I've passed another test, he told himself smugly. Riding on Draco must have been the first. How many more, I wonder? Fighting with broadswords?

But there were no more, and the answer to the immemorial 'Your place or mine?' was - Poole's.

The next morning, shaken and mortified, he contacted Professor Anderson.

'Everything was going splendidly,' he lamented, 'when she suddenly became hysterical and pushed me away. I was afraid I'd hurt her somehow -'Then she called the roomlight - we'd been in darkness - and jumped out of bed. I guess I was just staring like a fool...' He laughed ruefully. 'She was certainly worth staring at.'

'I'm sure of it. Go on.'

'After a few minutes she relaxed and said something I'll never be able to forget.'

Anderson waited patiently for Poole to compose himself. 'She said: "I'm really sorry, Frank. We could have had a good time. But I didn't know that you'd been - mutilated."

The professor looked baffled, but only for a moment. 'Oh - I understand. I'm sorry too, Frank - perhaps I should have warned you. In my thirty years of practice, I've only seen half a dozen cases - all for valid medical reasons, which certainly didn't apply to you...'

'Circumcision made a lot of sense in primitive times - and even in your century - as a defence against some unpleasant - even fatal - diseases in backward countries with poor hygiene. But otherwise there was absolutely no excuse for it - and several arguments against, as you've just discovered!'

'I checked the records after I'd examined you the first time, and found that by mid-twenty-first century there had been so many malpractice suits that the American Medical Association had been forced to ban it. The arguments among the contemporary doctors are very entertaining.'

'I'm sure they are,' said Poole morosely.

'In some countries it continued for another century: then some unknown genius coined a slogan - please excuse the vulgarity - "God designed us: circumcision is blasphemy". That more or less ended the practice. But if you want, it would be easy to arrange a transplant - you wouldn't be making medical history, by any means.'

'I don't think it would work. Afraid I'd start laughing every time.'

'That's the spirit - you're already getting over it.'

Somewhat to his surprise, Poole realized that Anderson's prognosis was correct. He even found himself already laughing.

'Now what, Frank?'

'Aurora's "Society for Creative Anachronisms". I'd hoped it would improve my chances. Just my luck to have found one anachronism she doesn't appreciate.'

13
Stranger in a Strange Time

Indra was not quite as sympathetic as he had hoped: perhaps, after all, there was some sexual jealousy in their relationship. And - much more serious - what they wryly labelled the Dragon Debacle led to their first real argument.

It began innocently enough, when Indra complained:

'People are always asking me why I've devoted my life to such a horrible period of history, and it's not much of an answer to say that there were even worse ones.'

'Then why are you interested in my century?'

'Because it marks the transition between barbarism and civilization.'

'Thank you. Just call me Conan.'

'Conan? The only one I know is the man who invented Sherlock Holmes.'

'Never mind - sorry I interrupted. Of course, we in the so-called developed countries thought we were civilized. At least war wasn't respectable any more, and the United Nations was always doing its best to stop the wars that did break out.'

'Not very successfully: I'd give it about three out of ten. But what we find incredible is the way that people - right up to the early 2000s! - calmly accepted behaviour we would consider atrocious. And believed in the most mind-boggled -'

'Boggling.'

'- nonsense, which surely any rational person would dismiss out of hand.'

'Examples, please.'

'Well, your really trivial loss started me doing some research, and I was appalled by what I found. Did you know that every year in some countries thousands of little girls were hideously mutilated to preserve their virginity? Many of them died - but the authorities turned a blind eye.'

'I agree that was terrible - but what could my government do about it?'

'A great deal - if it wished. But that would have offended the people who supplied it with oil and bought its weapons, like the landmines that killed and maimed civilians by the thousand.'

'You don't understand, Indra. Often we had no choice: we couldn't reform the whole world. And didn't somebody once say "Politics is the art of the possible"?'

'Quite true - which is why only second-rate minds go into it. Genius likes to challenge the impossible.'

'Well, I'm glad you have a good supply of genius, so you can put things right.'

'Do I detect a hint of sarcasm? Thanks to our computers, we can run political experiments in cyberspace before trying them out in practice. Lenin was unlucky; he was born a hundred years too soon. Russian communism might have worked - at least for a while - if it had had microchips. And had managed to avoid Stalin.'

Poole was constantly amazed by Indra's knowledge of his age - as well as by her ignorance of so much that he took for granted. In a way, he had the reverse problem. Even if he lived the hundred years that had been confidently promised him, he could never learn enough to feel at home. In any conversation, there would always be references he did not understand, and jokes that would go over his head. Worse still, he would always feel on the verge of some "faux pas" - about to create some social disaster that would embarrass even the best of his new friends...

Such as the occasion when he was lunching, fortunately in his own quarters, with Indra and Professor Anderson. The meals that emerged from the autochef were always perfectly acceptable, having been designed to match his physiological requirements. But they were certainly nothing to get excited about, and would have been the despair of a twenty-first-century gourmet.

Then, one day, an unusually tasty dish appeared, which brought back vivid memories of the deer-hunts and barbecues of his youth. However, there was something unfamiliar about both flavour and texture, so Poole asked the obvious question.

Anderson merely smiled, but for a few seconds Indra looked as if she was about to be sick. Then she recovered and said: 'You tell him - after we've finished eating.'

Now what have I done wrong? Poole asked himself. Half an hour later, with Indra rather pointedly absorbed in a video display at the other end of the room, his knowledge of the Third Millennium made another major advance.

'Corpse-food was on the way out even in your time,' Anderson explained. 'Raising animals to - ugh - eat them became economically impossible. I don't know how many acres of land it took to feed one cow, but at least ten humans could survive on the plants it produced. And probably a hundred, with hydroponic techniques.

'But what finished the whole horrible business was not economics - but disease. It started first with cattle, then spread to other food animals - a kind of virus, I believe, that affected the brain, and caused a particularly nasty death. Although a cure was eventually found, it was too late to turn back the clock - and anyway, synthetic foods were now far cheaper, and you could get them in any flavour you liked.'

Remembering weeks of satisfying but unexciting meals, Poole had strong reservations about this. For why, he wondered, did he still have wistful dreams of spare-ribs and cordon bleu steaks?

Other dreams were far more disturbing, and he was afraid that before long he would have to ask Anderson for medical assistance. Despite everything that was being done to make him feel at home, the strangeness and sheer complexity of this new world were beginning to overwhelm him. During sleep, as if in an unconscious effort to escape, he often reverted to his earlier life: but when he awoke, that only made matters worse.

He had travelled across to America Tower and looked down, in reality and not in simulation, on the landscape of his youth - and it had not been a good idea. With optical aid, when the atmosphere was clear, he'd got so close that he could see individual human beings as they went about their affairs, sometimes along streets that he remembered...

And always, at the back of his mind, was the knowledge that down there had once lived everyone he had ever loved, Mother, Father (before he had gone off with that Other Woman), dear Uncle George and Aunt Lil, brother Martin - and, not least, a succession of dogs, beginning with the warm puppies of his earliest childhood and culminating in Rikki.

Above all, there was the memory - and mystery - of Helena...

It had begun as a casual affair, in the early days of his astrotraining, but had become more and more serious as the years went by. Just before he had left for Jupiter, they had planned to make it permanent when he returned.

And if he did not, Helena wished to have his child. He still recalled the blend of solemnity and hilarity with which they had made the necessary arrangements...

Now, a thousand years later, despite all his efforts, he had been unable to find if Helena had kept her promise. Just as there were now gaps in his own memory, so there were also in the collective records of Mankind. The worst was that created by the devastating electromagnetic pulse from the 2304 asteroid impact, which had wiped out several per cent of the world's information banks, despite all backups and safety systems. Poole could not help wondering if, among all the exabytes that were irretrievably lost, were the records of his own children: even now, his descendants of the thirtieth generation might be walking the Earth; but he would never know.

It helped a little to have discovered that - unlike Aurora -some ladies of this era did not consider him to be damaged goods. On the contrary: they often found his alteration quite exciting, but this slightly bizarre reaction made it impossible for Poole to establish any close relationship. Nor was he anxious to do so; all that he really needed was the occasional healthy, mindless exercise.

Mindless - that was the trouble. He no longer had arty purpose in life. And the weight of too many memories was upon him; echoing the title of a famous book he had read in his youth, he often said to himself, 'I am a Stranger in a Strange Time.'

There were even occasions when he looked down at the beautiful planet on which - if he obeyed doctor's orders - he could never walk again, and wondered what it would be like to make a second acquaintance with the vacuum of space.

Though it was not easy to get through the airlocks without triggering some alarm, it had been done: every few years, some determined suicide made a brief meteoric display in the Earth's atmosphere.

Perhaps it was just as well that deliverance was on its way, from a completely unexpected direction.

* * *

'Nice to meet you, Commander Poole - for the second time.'

'I'm sorry - don't recall - but then I see so many people.'

'No need to apologize. First time was out round Neptune.'

'Captain Chandler - delighted to see you! Can I get something from the autochef?'

'Anything with over twenty per cent alcohol will be fine.'

'And what are you doing back on Earth? They told me you never come inside Mars orbit.'

'Almost true - though I was born here, I think it's a dirty, smelly place - too many people - creeping up to a billion again!'

'More than ten billion in my time. By the way, did you get my "Thank you" message?'

'Yes - and I know I should have contacted you. But I waited until I headed sunwards again. So here I am. Your good health!'

As the Captain disposed of his drink with impressive speed, Poole tried to analyse his visitor. Beards - even small goatees like Chandler's - were very rare in this society, and he had never known an astronaut who wore one: they did not co-exist comfortably with space-helmets. Of course, a Captain might go for years between EVs, and in any case most outside jobs were done by robots; but there was always the risk of the unexpected, when one might have to get suited in a hurry. It was obvious that Chandler was something of an eccentric, and Poole's heart warmed to him.

'You've not answered my question. If you don't like Earth, what are you doing here?'

'Oh, mostly contacting old friends - it's wonderful to forget hour-long delays, and to have real-time conversations! But of course that's not the reason. My old rust-bucket is having a refit, up at the Rim shipyard. And the armour has to be replaced; when it gets down to a few centimetres thick, I don't sleep too well.'

'Armour?'

'Dust shield. Not such a problem in your time, was it? But it's a dirty environment out round Jupiter, and our normal cruise speed is several thousand

klicks - a second! So there's a continuous gentle pattering, like raindrops on the roof.'

'You're joking!'

'Course I am. If we really could hear anything, we'd be dead. Luckily, this sort of unpleasantness is very rare - last serious accident was twenty years ago. We know all the main comet streams, where most of the junk is, and are careful to avoid them - except when we're matching velocity to round up ice.

'But why don't you come aboard and have a look around, before we take off for Jupiter?'

'I'd be delighted... did you say Jupiter?'

'Well, Ganymede, of course - Anubis City. We've a lot of business there, and several of us have families we haven't seen for months.'

Poole scarcely heard him.

Suddenly - unexpectedly - and perhaps none too soon, he had found a reason for living.

Commander Frank Poole was the sort of man who hated to leave a job undone - and a few specks of cosmic dust, even moving at a thousand kilometres a second, were not likely to discourage him.

He had unfinished business at the world once known as Jupiter.

II
GOLIATH

14
A Farewell to Earth

'Anything you want within reason,' he had been told. Frank Poole was not sure if his hosts would consider that returning to Jupiter was a reasonable request; indeed, he was not quite sure himself, and was beginning to have second thoughts.

He had already committed himself to scores of engagements, weeks in advance. Most of them he would be happy to miss, but there were some he would be sorry to forgo. In particular, he hated to disappoint the senior class from his old high school - how astonishing that it still existed! - when they planned to visit him next month.

However, he was relieved - and a little surprised - when both Indra and Professor Anderson agreed that it was an excellent idea. For the first time, he realized that they had been concerned with his mental health; perhaps a holiday from Earth would be the best possible cure.

And, most important of all, Captain Chandler was delighted. 'You can have my cabin,' he promised. 'I'll kick the First Mate out of hers.' There were times when Poole wondered if Chandler, with his beard and swagger, was not another anachronism. He could easily picture him on the bridge of a battered three-master, with Skull and Crossbones flying overhead.

Once his decision had been made, events moved with surprising speed. He had accumulated very few possessions, and fewer still that he needed to take with him. The most important was Miss Pringle, his electronic alter ego and secretary, now the storehouse of both his lives, and the small stack of terabyte memories that went with her.

Miss Pringle was not much larger than the hand-held personal assistants of his own age, and usually lived, like the Old West's Colt 45, in a quick-draw holster at his waist. She could communicate with him by audio or Braincap, and her prime duty was to act as an information filter and a buffer to the outside world. Like any good secretary, she knew when to reply, in the appropriate format: 'I'll put you through now' or - much more frequently: 'I'm sorry - Mr Poole is engaged. Please record your message and he will get back to you as soon as possible.' Usually, this was never.

There were very few farewells to be made: though realtime conversations would be impossible owing to the sluggish velocity of radio waves, he would be in constant touch with Indra and Joseph - the only genuine friends he had made.

Somewhat to his surprise, Poole realized that he would miss his enigmatic but useful 'valet', because he would now have to handle all the small chores of everyday life by himself. Danil bowed slightly when they parted, but otherwise showed no sign of emotion, as they took the long ride up to the outer curve of the world-circling wheel, thirty-six thousand kilometres above central Africa.

'I'm not sure, Dim, that you'll appreciate the comparison. But do you know what Goliath reminds me of?'

They were now such good friends that Poole could use the Captain's nickname - but only when no one else was around.

'Something unflattering, I assume.'

'Not really. But when I was a boy, I came across a whole pile of old science-fiction magazines that my Uncle George had abandoned - "pulps", they were called, after the cheap paper they were printed on... most of them were already falling to bits. They had wonderful garish covers, showing strange planets and monsters - and, of course, spaceships!

'As I grew older, I realized how ridiculous those spaceships were. They were usually rocket-driven - but there was never any sign of propellant tanks! Some of them had rows of windows from stem to stem, just like ocean liners. There was one favourite of mine with a huge glass dome - a space-going conservatory...

'Well, those old artists had the last laugh: too bad they could never know. Goliath looks more like their dreams than the flying fuel-tanks we used to launch from the Cape.

Your Inertial Drive still seems too good to be true - no visible means of support, unlimited range and speed - sometimes I think I'm the one who's dreaming!'

Chandler laughed and pointed to the view outside.

'Does that look like a dream?'

It was the first time that Poole had seen a genuine horizon since he had come to Star City, and it was not quite as far away as he had expected. After all, he was on the outer rim of a wheel seven times the diameter of Earth, so surely the view across the roof of this artificial world should extend for several hundred kilometres...

He used to be good at mental arithmetic - a rare achievement even in his time, and probably much rarer now. The formula to give the horizon distance was a simple one: the square root of twice your height times the radius - the sort of thing you never forgot, even if you wanted to...

Let's see - we're about 8 metres up - so root 16 - this is easy! - say big R is 40,000 - knock off those three zeros to make it all klicks - 4 times root 40 - hmm - just over 25...

Well, twenty-five kilometres was a fair distance, and certainly no spaceport on Earth had ever seemed this huge. Even knowing perfectly well what to expect, it was uncanny to watch vessels many times the size of his long-lost Discovery lifting off, not only with no sound, but with no apparent means of propulsion. Though Poole missed the flame and fury of the old-time countdowns, he had to admit that this was cleaner, more efficient - and far safer.

Strangest of all, though, was to sit up here on the Rim, in the Geostationary Orbit itself - and to feel weight! Just metres away, outside the window of the tiny observation lounge, servicing robots and a few spacesuited humans were gliding gently about their business; yet here inside Goliath the inertial field was maintaining standard Mars-gee.

'Sure you don't want to change your mind, Frank?' Captain Chandler had asked jokingly, as he left for the bridge. 'Still ten minutes before lift-off.'

'Wouldn't be very popular if I did, would I? No - as they used to say back in the old days - we have commit. Ready or not, here I come.'

Poole felt the need to be alone when the drive went on, and the tiny crew - only four men and three women - respected his wish. Perhaps they guessed how he must be feeling, to leave Earth for the second time in a thousand years - and, once again, to face an unknown destiny.

Jupiter-Lucifer was on the other side of the Sun, and the almost straight line of Goliath's orbit would take them close to Venus. Poole looked forward to seeing, with his own unaided eyes, if Earth's sister planet was now beginning to live up to that description, after centuries of terraforming.

From a thousand kilometres up, Star City looked like a gigantic metal band around Earth's Equator, dotted with gantries, pressure domes, scaffolding holding half-completed ships, antennas, and other more enigmatic structures. It was diminishing swiftly as Goliath headed sunwards, and presently Poole could

see how incomplete it was: there were huge gaps spanned only by a spider's web of scaffolding, which would probably never be completely enclosed.

And now they were falling below the plane of the ring; it was midwinter in the northern hemisphere, so the slim halo of Star City was inclined at over twenty degrees to the Sun. Already Poole could see the American and Asian towers, as shining threads stretching outwards and away, beyond the blue haze of the atmosphere.

He was barely conscious of time as Goliath gained speed, moving more swiftly than any comet that had ever fallen sunwards from interstellar space. The Earth, almost full, still spanned his field of view, and he could now see the full length of the Africa Tower which had been his home in the life he was now leaving - perhaps, he could not help thinking, leaving for ever.

When they were fifty thousand kilometres out, he was able to view the whole of Star City, as a narrow ellipse enclosing the Earth. Though the far side was barely visible, as a hair-line of light against the stars, it was awe-inspiring to think that the human race had now set this sign upon the heavens.

Then Poole remembered the rings of Saturn, infinitely more glorious. The astronautical engineers still had a long, long way to go, before they could match the achievements of Nature.

Or, if that was the right word, Deus.

15
Transit of Venus

When he woke the next morning, they were already at Venus. But the huge, dazzling crescent of the still cloud-wrapped planet was not the most striking object in the sky:

Goliath was floating above an endless expanse of crinkled silver foil, flashing in the sunlight with ever-changing patterns as the ship drifted across it.

Poole remembered that in his own age there had been an artist who had wrapped whole buildings in plastic sheets: how he would have loved this opportunity to package billions of tons of ice in a glittering envelope... Only in this way could the core of a comet be protected from evaporation on its decades-long journey sunwards.

'You're in luck, Frank,' Chandler had told him. 'This is something I've never seen myself. It should be spectacular. Impact due in just over an hour. We've given it a little nudge, to make sure it comes down in the right place. Don't want anyone to get hurt.'

Poole looked at him in astonishment.

'You mean - there are already people on Venus?'

'About fifty mad scientists, near the South Pole. Of course, they're well dug in, but we should shake them up a bit - even though Ground Zero is on the other side of the planet. Or I should say "Atmosphere Zero" - it will be days before anything except the shockwave gets down to the surface.'

As the cosmic iceberg, sparkling and flashing in its protective envelope, dwindled away towards Venus, Poole was struck with a sudden, poignant memory. The Christmas trees of his childhood had been adorned with just such ornaments, delicate bubbles of coloured glass. And the comparison was not completely ludicrous: for many families on Earth, this was still the right season for gifts, and Goliath was bringing a present beyond price to another world.

The radar image of the tortured Venusian landscape - its weird volcanoes, pancake domes, and narrow, sinuous canyons - dominated the main screen of Goliath's control centre, but Poole preferred the evidence of his own eyes. Although the unbroken sea of clouds that covered the planet revealed nothing of the inferno beneath, he wanted to see what would happen when the stolen comet struck. In a matter of seconds, the myriad of tons of frozen hydrates that had been gathering speed for decades on the downhill run from Neptune would deliver all their energy...

The initial flash was even brighter than he had expected. How strange that a missile made of ice could generate temperatures that must be in the tens of thousands of degrees! Though the filters of the view-port would have absorbed all the dangerous shorter wave-lengths, the fierce blue of the fireball proclaimed that it was hotter than the Sun.

It was cooling rapidly as it expanded - through yellow, orange, red... The shockwave would now be spreading outwards at the velocity of sound - and what a sound that must be! - so in a few minutes there should be some visible indication of its passage across the face of Venus.

And there it was! Only a tiny black ring - like an insignificant puff of smoke, giving no hint of the cyclonic fury that must be blasting its way outwards from the point of impact. As Poole watched, it slowly expanded, though owing to its scale there was no sense of visible movement: he had to wait for a full minute before he could be quite sure that it had grown larger.

After a quarter of an hour, however, it was the most prominent marking on the planet. Though much fainter - a dirty grey, rather than black - the shockwave was now a ragged circle more than a thousand kilometres across. Poole guessed that it had lost its original symmetry while sweeping over the great mountain ranges that lay beneath it.

Captain Chandler's voice sounded briskly over the ship's address system.

'Putting you through to Aphrodite Base. Glad to say they're not shouting for help -'

'- shook us up a bit, but just what we expected. Monitors indicate some rain already over the Nokomis Mountains - it will soon evaporate, but that's a beginning. And there seems to have been a flash-flood in Hecate Chasm - too good to be true, but we're checking. There was a temporary lake of boiling water there after the last delivery -'

I don't envy them, Poole told himself - but I certainly admire them. They prove that the spirit of adventure still exists in this perhaps too-comfortable and too-well-adjusted society.

'- and thanks again for bringing this little load down in the right place. With any luck - and if we can get that sun-screen up into sync orbit - we'll have some permanent seas before long. And then we can plant coral reefs, to make lime and pull the excess CO2 out of the atmosphere - hope I live to see it!'

I hope you do, thought Poole in silent admiration. He had often dived in the tropical seas of Earth, admiring weird and colourful creatures so bizarre that it was hard to believe anything stranger would be found, even on the planets of other suns.

'Package delivered on time, and receipt acknowledged,' said Captain Chandler with obvious satisfaction. 'Goodbye Venus - Ganymede, here we come.'

MISS PRINGLE

FILE WALLACE

Hello, Indra. Yes, you were quite right. I do miss our little arguments. Chandler and I get along fine, and at first the crew treated me - this will amuse you - rather like a holy relic. But they're beginning to accept me, and have even started to pull my leg (do you know that idiom?).

It's annoying not to be able to have a real conversation - we've crossed the orbit of Mars, so radio round-trip is already over an hour. But there's one advantage - you won't be able to interrupt me...

Even though it will take us only a week to reach Jupiter, I thought I'd have time to relax. Not a bit of it: my fingers started to itch, and I couldn't resist going back to school. So I've begun basic training, all over again, in one of Goliath's minishuttles. Maybe Dim will actually let me solo...

It's not much bigger than Discovery's pods - but what a difference! First of all, of course, it doesn't use rockets: I can't get used to the luxury of the inertial drive, and unlimited range. Could fly back to Earth if I had to - though I'd probably get - remember the phrase I used once, and you guessed its meaning? - 'stir crazy'.

The biggest difference, though, is the control system. It's been a big challenge for me to get used to hands-off operation - and the computer has had to learn to recognize my voice commands. At first it was asking every five minutes 'Do you really mean that?' I know it would be better to use the Braincap - but I'm still not completely confident with that gadget. Not sure if I'll ever get used to something reading my mind.

By the way, the shuttle's called Falcon. It's a nice name - and I was disappointed to find that no one aboard knew that it goes all the way back to the Apollo missions, when we first landed on the Moon...

Uh-huh - there was a lot more I wanted to say, but the skipper is calling. Back to the classroom - love and out.

STORE

TRANSMIT

Hello Frank - Indra calling - if that's right word! - on my new Thoughtwriter - old one had nervous breakdown ha ha - so be lots of mistakes - no time to edit before I send. Hope you can make sense.

COMSET! Channel one oh three - record from twelve thirty - correction - thirteen thirty. Sorry...

Hope I can get old unit fixed - knew all my short-cuts and abbrieves - maybe should get psychoanalysed like in your time - never understood how that Fraudian - mean Freudian ha ha - nonsense lasted as long as it did - Reminds me - came across late Twentieth defin other day - may amuse you - something like this - quote -Psychoanalysis - contagious disease originating Vienna circa 1900 - now extinct in Europe but occasional outbreaks among rich Americans. Unquote. Funny?

Sorry again - trouble with Thoughtwriters - hard to stick to point -xz 12€ w 888 5***** js98l2yebdc DAMN... STOP BACKUP

Did I do something wrong then? Will try again. You mentioned Danil... sorry we always evaded your questions about him - knew you were curious, but we had very good reason - remember you once called him a non-person?... not bad guess...!

Once you asked me about crime nowadays - I said any such interest pathological - maybe prompted by the endless sickening television programmes of your time - never able to watch more than few minutes myself... disgusting!

DOOR ACKNOWLEDGE! OH, HELLO MELINDA EXCUSE SIT DOWN NEARLY FINISHED...

Yes - crime. Always some... Society's irreducible noise level. What to do?

Your solution - prisons. State-sponsored perversion factories - costing ten times average family income to hold one inmate! Utterly crazy... Obviously something very wrong with people who shouted loudest for more prisons - They should be psychoanalysed! But let's be fair - really no alternative before electronic monitoring and control perfected - you should see the joyful crowds smashing the prison walls then - nothing like it since Berlin fifty years earlier!

Yes - Danil. I don't know what his crime was - wouldn't tell you if I did - but presume his psych profile suggested he'd make a good - what was the word? - ballet - no, valet. Very hard to get people for some jobs - don't know how we'd manage if crime level zero! Anyway hope he's soon decontrolled and back in normal society

SORRY MELINDA NEARLY FINISHED

That's it, Frank - regards to Dimitrj - you must be halfway to Ganymede now - wonder if they'll ever repeal Einstein so we can talk across space in real-time!

Hope this machine soon gets used to me. Otherwise be looking round for genuine antique twentieth century word processor... Would you believe - once even mastered that QWERTYIYUIOP nonsense, which you took a couple of hundred years to get rid of?

Love and good-bye.

* * *

Hello Frank - here I am again. Still waiting acknowledgement of my last...

Strange you should be heading towards Ganymede, and my old friend Ted Khan. But perhaps it's not such a coincidence: he was drawn by the same enigma that you were...

First I must tell you something about him. His parents played a dirty trick, giving him the name Theodore. That shortens - don't ever call him that! - to Theo. See what I mean?

Can't help wondering if that's what drives him. Don't know anyone else who's developed such an interest in religion - no, obsession. Better warn you; he can be quite a bore.

By the way, how am I doing? I miss my old Thinkwriter, but seem to be getting this machine under control. Haven't made any bad - what did you call them? - bloopers - glitches - fluffs - so far at least - Not sure I should tell you this, in case you accidentally blurt it out, but my private nickname for Ted is 'The Last Jesuit'. You must know something about them - the Order was still very active in your time.

Amazing people - often great scientists - superb scholars - did a tremendous amount of good as well as much harm. One of history's supreme ironies - sincere and brilliant seekers of knowledge and truth, yet their whole philosophy hopelessly distorted by superstition...

Xuedn2k3jn deer 2leidj dwpp

Damn. Got emotional and lost control. One, two, three, four... now is the time for all good men to come to the aid of the party... that's better.

Anyway, Ted has that same brand of high-minded determination; don't get into any arguments with him - he'll go over you like a steam-roller.

By the way what were steam-rollers? Used for pressing clothes? Can see how that could be very uncomfortable...

Trouble with Thinkwriters... too easy to go off in all directions, no matter how hard you try to discipline yourself... something to be said for keyboards after all... sure I've said that before...

Ted Khan... Ted Khan... Ted Khan

He's still famous back on Earth for at least two of his sayings: 'Civilization and Religion are incompatible' and 'Faith is believing what you know isn't true'. Actually, I don't think the last one is original; if it is, that's the nearest he ever got to a joke. He never cracked a smile when I tried one of my favourites on him - hope you haven't heard it before. It obviously dates from your time.

The Dean's complaining to his Faculty. 'Why do you scientists need such expensive equipment? Why can't you be like the Maths Department, which only needs a blackboard and a waste-paper basket? Better still, like the Department of Philosophy. That doesn't even need a wastepaper basket...' Well, perhaps Ted had heard it before... I expect most philosophers have...

Anyway, give him my regards - and don't, repeat don't, get into any arguments with him!

Love and best wishes from Africa Tower.

TRANSCRIBE STORE

TRANSMIT POOLE

16
The Captain's Table

The arrival of such a distinguished passenger had caused a certain disruption in the tight little world of Goliath, but the crew had adapted to it with good humour. Every day, at 18.00 hours, all personnel gathered for dinner in the wardroom, which in zero-gee could hold at least thirty people in comfort, if spread uniformly around the walls. However, most of the time the ship's working areas were held at lunar gravity, so there was an undeniable floor - and more than eight bodies made a crowd.

The semi-circular table that unfolded around the auto-chef at mealtimes could just seat the entire seven-person crew, with the Captain at the place of honour. One extra created such insuperable problems that somebody now had to eat alone for every meal. After much good-natured debate, it was decided to make the choice in alphabetical order - not of proper names, which were hardly ever used, but of nicknames. It had taken Poole some time to get used to them: 'Bolts' (structural engineering); 'Chips' (computers and communications); 'First' (First Mate); 'Life' (medical and life-support systems); 'Props' (propulsion and power); and 'Stars' (orbits and navigation).

During the ten-day voyage, as he listened to the stories, jokes and complaints of his temporary shipmates, Poole learned more about the solar system than during his months on Earth. All aboard were obviously delighted to have a new and perhaps naïve listener as an attentive one-man audience, but Poole was seldom taken in by their more imaginative stories.

Yet sometimes it was hard to know where to draw the line. No one really believed in the Golden Asteroid, which was usually regarded as a twenty-fourth-

century hoax. But what about the Mercurian plasmoids, which had been reported by at least a dozen reliable witnesses during the last five hundred years?

The simplest explanation was that they were related to ball-lightning, responsible for so many 'Unidentified Flying Object' reports on Earth and Mars. But some observers swore that they had shown purposefulness - even inquisitiveness - when they were encountered at close quarters. Nonsense, answered the sceptics - merely electrostatic attraction!

Inevitably, this led to discussions about life in the Universe, and Poole found himself - not for the first time -defending his own era against its extremes of credulity and scepticism. Although the 'Aliens are among us' mania had already subsided when he was a boy, even as late as the 2020s the Space Agency was still plagued by lunatics who claimed to have been contacted - or abducted - by visitors from other worlds. Their delusions had been reinforced by sensational media exploitation, and the whole syndrome was later enshrined in the medical literature as 'Adamski's Disease'.

The discovery of TMA ONE had, paradoxically, put an end to this sorry nonsense, by demonstrating that though there was indeed intelligence elsewhere, it had apparently not concerned itself with Mankind for several million years. TMA ONE had also convincingly refuted the handful of scientists who argued that life above the bacterial level was such an improbable phenomenon that the human race was alone in this Galaxy - if not the Cosmos.

Goliath's crew was more interested in the technology than the politics and economics of Poole's era, and were particularly fascinated by the revolution that had taken place in his own lifetime - the end of the fossil-fuel age, triggered by the harnessing of vacuum energy. They found it hard to imagine the smog-choked cities of the twentieth century, and the waste, greed and appalling environmental disasters of the Oil Age.

'Don't blame me,' said Poole, fighting back gamely after one round of criticism. 'Anyway, see what a mess the twenty-first century made.'

There was a chorus of 'What do you mean?'s around the table.

'Well, as soon as the so-called Age of Infinite Power got under way, and everyone had thousands of kilowatts of cheap, clean energy to play with - you know what happened!'

'Oh, you mean the Thermal Crisis. But that was fixed.'

'Eventually - after you'd covered half the Earth with reflectors to bounce the Sun's heat back into space. Otherwise it would have been as parboiled as Venus by now.'

The crew's knowledge of Third Millennium history was so surprisingly limited that Poole - thanks to the intensive education he had received in Star City - could often amaze them with details of events centuries after his own time. However, he was flattered to discover how well-acquainted they were with Discovery's log, it had become one of the classic records of the Space Age. They looked on it as he might have regarded a Viking saga; often he had to remind himself that he was midway in time between Goliath and the first ships to cross the western ocean...

'On your Day 86,' Stars reminded him, at dinner on the fifth evening, 'you passed within two thousand kay of asteroid 7794 - and shot a probe into it. Do you remember?"

'Of course I do,' Poole answered rather brusquely 'To me, it happened less than a year ago'

'Um, sorry. Well, tomorrow we'll be even closer to 13,445. Like to have a look?' With autoguidance and freeze-frame, we should have a window all of ten milliseconds wide.'

A hundredth of a second! That few minutes in Discovery had seemed hectic enough, but now everything would happen fifty times faster.

'How large is it?' Poole asked.

'Thirty by twenty by fifteen metres,' Stars replied. 'Looks like a battered brick.'

'Sorry we don't have a slug to fire at it,' said Props. 'Did you ever wonder if 7794 would hit back?'

'Never occurred to us. But it did give the astronomers a lot of useful information, so it was worth the risk... Anyway, a hundredth of a second hardly seems worth the bother. Thanks all the same.'

'I understand. When you've seen one asteroid, you've seen them -'

'Not true, Chips. When I was on Eros -'

'As you've told us at least a dozen times -, Poole's mind tuned out the discussion, so that it was a background of meaningless noise. He was a thousand years in the past, recalling the only excitement of Discovery's mission before the final disaster. Though he and Bowman were perfectly aware that 7794 was merely a lifeless, airless chunk of rock, that knowledge scarcely affected their feelings. It was the only solid matter they would meet this side of Jupiter, and they had stared at it with the emotions of sailors on a long sea voyage, skirting a coast on which they could not land.

It was turning slowly end over end, and there were mottled patches of light and shade distributed at random over its surface. Sometimes it sparkled like a distant window, as planes or outcroppings of crystalline material flashed in the Sun...

He remembered, also, the mounting tension as they waited to see if their aim had been accurate. It was not easy to hit such a small target, two thousand kilometres away, moving at a relative velocity of twenty kilometres a second.

Then, against the darkened portion of the asteroid, there had been a sudden, dazzling explosion of light. The tiny slug - pure Uranium 238 - had impacted at meteoric speed: in a fraction of a second, all its kinetic energy had been transformed into heat. A puff of incandescent gas had erupted briefly into space, and Discovery's cameras were recording the rapidly fading spectral lines, looking for the tell-tale signatures of glowing atoms. A few hours later, back on Earth, the astronomers learned for the first time the composition of an asteroid's crust. There were no major surprises, but several bottles of champagne changed hands.

Captain Chandler himself took little part in the very democratic discussions around his semi-circular table: he seemed content to let his crew relax and express their feelings in this informal atmosphere. There was only one unspoken rule: no serious business at mealtimes. If there were any technical or operational problems, they had to be dealt with elsewhere.

Poole had been surprised - and a little shocked - to discover that the crew's knowledge of Goliath's systems was very superficial. Often he had asked questions which should have been easily answered, only to be referred to the ship's own memory banks. After a while, however, he realized that the sort of in-depth training he had received in his days was no longer possible: far too many complex systems were involved for any man or woman's mind to master. The various specialists merely had to know what their equipment did, not how. Reliability depended on redundancy and automatic checking, and human intervention was much more likely to do harm than good.

Fortunately none was required on this voyage: it had been as uneventful as any skipper could have hoped, when the new sun of Lucifer dominated the sky ahead.

III
THE WORLDS OF GALILEO

(Extract, text only, Tourist's Guide to Outer Solar System, v 219.3)

Even today, the giant satellites of what was once Jupiter present us with major mysteries. Why are four worlds, orbiting the same primary and very similar in size, so different in most other respects?

Only in the case of Io, the innermost satellite, is there a convincing explanation. It is so close to Jupiter that the gravitational tides constantly kneading its interior generate colossal quantities of heat - so much, indeed, that Io's surface is semi-molten. It is the most volcanically active world in the Solar System; maps of Io have a half-life of only a few decades.

Though no permanent human bases have ever been established in such an unstable environment, there have been numerous landings and there is continuous robot monitoring. (For the tragic fate of the 2571 Expedition, see Beagle 5.)

Europa, second in distance from Jupiter, was originally entirely covered in ice, and showed few surface features except a complicated network of cracks. The tidal forces which dominate Io were much less powerful here, but produced enough heat to give Europa a global ocean of liquid water, in which many strange life-forms have evolved.

In 2010 the Chinese ship Tsien touched down on Europa on one of the few outcrops of solid rock protruding through the crust of ice. In doing so it disturbed a creature of the Europan abyss and was destroyed (see Spacecraft Tsien, Galaxy, Universe).

Since the conversion of Jupiter into the mini-sun Lucifer in 2061, virtually all of Europa's ice-cover has melted, and extensive vulcanism has created several small islands.

As is well-known, there have been no landings on Europa for almost a thousand years, but the satellite is under continuous surveillance.

Ganymede, largest moon in the Solar System (diameter 5260 kilometres), has also been affected by the creation of a new sun, and its equatorial regions are warm enough to sustain terrestrial life-forms, though it does not yet have a breathable atmosphere. Most of its population is actively engaged in terraforming and scientific research; the main settlement is Anubis (pop 41,000), near the South Pole.

Callisto is again wholly different. Its entire surface is covered by impact craters of all sizes, so numerous that they overlap. The bombardment must have continued for millions of years, for the newer craters have completely obliterated the earlier ones. There is no permanent base on Callisto, but several automatic stations have been established there.

17
Ganymede

It was unusual for Frank Poole to oversleep, but he had been kept awake by strange dreams. Past and present were inextricably mixed; sometimes he was on Discovery, sometimes in the Africa Tower - and sometimes he was a boy again, among friends he had thought long-forgotten.

Where am I? he asked himself as he struggled up to consciousness, like a swimmer trying to get back to the surface. There was a small window just above his bed, covered by a curtain not thick enough to completely block the light from outside. There had been a time, around the mid-twentieth century, when aircraft had been slow enough to feature First Class sleeping accommodation: Poole had never sampled this nostalgic luxury, which some tourist organizations had still advertised in his own day, but he could easily imagine that he was doing so now.

He drew the curtain and looked out. No, he had not awakened in the skies of Earth, though the landscape unrolling below was not unlike the Antarctic. But the South Pole had never boasted two suns, both rising at once as Goliath swept towards them.

The ship was orbiting less than a hundred kilometres above what appeared to be an immense ploughed field, lightly dusted with snow. But the ploughman must have been drunk - or the guidance system must have gone crazy - for the furrows meandered in every direction, sometimes cutting across each other or turning back on themselves. Here and there the terrain was dotted with faint circles - ghost craters from meteor impacts aeons ago.

So this is Ganymede, Poole wondered drowsily. Mankind's furthest outpost from home! Why should any sensible person want to live here? Well, I've often thought that when I've flown over Greenland or Iceland in winter-time...

There was a knock on the door, a 'Mind if I come in?', and Captain Chandler did so without waiting for a reply.

'Thought we'd let you sleep until we landed - that end-of-trip party did last longer than I'd intended, but I couldn't risk a mutiny by cutting it short.'

Poole laughed.

'Has there ever been a mutiny in space?'

'Oh, quite a few but not in my time. Now we've mentioned the subject, you might say that Hal started the tradition... sorry - perhaps I shouldn't - look - there's Ganymede City!'

Coming up over the horizon was what appeared to be a criss-cross pattern of streets and avenues, intersecting almost at right-angles but with the slight irregularity typical of any settlement that had grown by accretion, without central planning. It was bisected by a broad river - Poole recalled that the equatorial regions of Ganymede were now warm enough for liquid water to exist - and it reminded him of an old wood-cut he had seen of medieval London.

Then he noticed that Chandler was looking at him with an expression of amusement... and the illusion vanished as he realized the scale of the 'city'.

'The Ganymedeans,' he said dryly, 'must have been rather large, to have made roads five or ten kilometres wide.'

'Twenty in some places. Impressive, isn't it? And all the result of ice stretching and contracting. Mother Nature is ingenious... I could show you some patterns that look even more artificial, though they're not as large as this one.'

'When I was a boy, there was a big fuss about a face on Mars. Of course, it turned out to be a hill that had been carved by sand-storms... lots of similar ones in Earth's deserts.'

'Didn't someone say that history always repeats itself? Same sort of nonsense happened with Ganymede City - some nuts claimed it had been built by aliens. But I'm afraid it won't be around much longer.'

'Why?' asked Poole in surprise.

'It's already started to collapse, as Lucifer melts the permafrost. You won't recognize Ganymede in another hundred years... there's the edge of Lake Gilgamesh - if you look carefully - over on the right-'

'I see what you mean. What's happening - surely the water's not boiling, even at this low pressure?'

'Electrolysis plant. Don't know how many skillions of kilograms of oxygen a day. Of course, the hydrogen goes up and gets lost - we hope.'

Chandler's voice trailed off into silence. Then he resumed, in an unusually diffident tone: 'All that beautiful water down there - Ganymede doesn't need half of it! Don't tell anyone, but I've been working out ways of getting some to Venus.'

'Easier than nudging comets?'

'As far as energy is concerned, yes - Ganymede's escape velocity is only three klicks per second. And much, much quicker - years instead of decades. But there are a few practical difficulties..

'I can appreciate that. Would you shoot it off by a mass-launcher?'

'Oh no - I'd use towers reaching up through the atmosphere, like the ones on Earth, but much smaller. We'd pump the water up to the top, freeze it down to near absolute zero, and let Ganymede sling it off in the right direction as it rotated. There would be some evaporation loss in transit, but most of it would arrive - what's so funny?'

'Sorry - I'm not laughing at the idea - it makes good sense. But you've brought back such a vivid memory. We used to have a garden sprinkler - driven round and round by its water jets. What you're planning is the same thing - on a slightly bigger scale... using a whole world...'

Suddenly, another image from his past obliterated all else. Poole remembered how, in those hot Arizona days, he and Rikki had loved to chase each other through the clouds of moving mist, from the slowly revolving spray of the garden sprinkler.

Captain Chandler was a much more sensitive man than he pretended to be: he knew when it was time to leave.

'Gotta get back to the bridge,' he said gruffly. 'See you when we land at Anubis.'

18
Grand Hotel

The Grand Ganymede Hotel - inevitably known throughout the Solar System as 'Hotel Grannymede' was certainly not grand, and would be lucky to get a rating of one-and-a-half stars on Earth. As the nearest competition was several hundred million kilometres away, the management felt little need to exert itself unduly.

Yet Poole had no complaints, though he often wished that Danil was still around, to help him with the mechanics of life and to communicate more efficiently with the semi-intelligent devices with which he was surrounded. He had known a brief moment of panic when the door had closed behind the (human) bellboy, who had apparently been too awed by his guest to explain how any of the room's services functioned. After five minutes of fruitless talking to the unresponsive walls, Poole had finally made contact with a system that understood his accent and his commands. What an 'All Worlds' news item it would have made - 'Historic astronaut starves to death, trapped in Ganymede hotel room'!

And there would have been a double irony. Perhaps the naming of the Grannymede's only luxury suite was inevitable, but it had been a real shock to meet an ancient life-size holo of his old shipmate, in full-dress uniform, as he was led into - the Bowman Suite. Poole even recognized the image: his own

official portrait had been made at the same time, a few days before the mission began.

He soon discovered that most of his Goliath crewmates had domestic arrangements in Anubis, and were anxious for him to meet their Significant Others during the ship's planned twenty-day stop. Almost immediately he was caught up in the social and professional life of this frontier settlement, and it was Africa Tower that now seemed a distant dream.

Like many Americans, in their secret hearts, Poole had a nostalgic affection for small communities where everyone knew everyone else - in the real world, and not the virtual one of cyberspace. Anubis, with a resident population less than that of his remembered Flagstaff, was not a bad approximation to this ideal.

The three main pressure domes, each two kilometres in diameter, stood on a plateau overlooking an ice-field which stretched unbroken to the horizon. Ganymede's second sun

- once known as Jupiter - would never give sufficient heat to melt the polar caps. This was the principal reason for establishing Anubis in such an inhospitable spot: the city's foundations were not likely to collapse for at least several centuries.

And inside the domes, it was easy to be completely indifferent to the outside world. Poole, when he had mastered the mechanisms of the Bowman Suite, discovered that he had a limited but impressive choice of environments. He could sit beneath palm trees on a Pacific beach, listening to the gentle murmur of the waves - or, if he preferred, the roar of a tropical hurricane. He could fly slowly along the peaks of the Himalayas, or down the immense canyons of Mariner Valley. He could walk through the gardens of Versailles or down the streets of half a dozen great cities, at several widely spaced times in their history. Even if the Hotel Grannymede was not one of the Solar System's most highly acclaimed resorts, it boasted facilities which would have astounded all its more famous predecessors on Earth.

But it was ridiculous to indulge in terrestrial nostalgia, when he had come half-way across the Solar System to visit a strange new world. After some experimenting, Poole arranged a compromise, for enjoyment - and inspiration - during his steadily fewer moments of leisure.

To his great regret, he had never been to Egypt, so it was delightful to relax beneath the gaze of the Sphinx - as it was before its controversial 'restoration' - and to watch tourists scrambling up the massive blocks of the Great Pyramid. The illusion was perfect, apart from the no-man's-land where the desert clashed with the (slightly worn) carpet of the Bowman Suite.

The sky, however, was one that no human eyes had seen until five thousand years after the last stone was laid at Giza. But it was not an illusion; it was the complex and ever-changing reality of Ganymede.

Because this world - like its companions - had been robbed of its spin aeons ago by the tidal drag of Jupiter, the new sun born from the giant planet hung motionless in its sky. One side of Ganymede was in perpetual Lucifer-light - and although the other hemisphere was often referred to as the 'Night Land', that designation was as misleading as the much earlier phrase 'The dark side of the Moon'. Like the lunar Farside, Ganymede's 'Night Land' had the brilliant light of old Sol for half of its long day.

By a coincidence more confusing than useful, Ganymede took almost exactly one week - seven days, three hours -to orbit its primary. Attempts to create a 'One Mede day = one Earth week' calendar had generated so much chaos that they had been abandoned centuries ago. Like all the other residents of the Solar System, the locals employed Universal Time, identifying their twenty-four-hour standard days by numbers rather than names.

Since Ganymede's newborn atmosphere was still extremely thin and almost cloudless, the parade of heavenly bodies provided a never-ending spectacle. At their closest, Io and Callisto each appeared about half the size of the Moon as seen from Earth - but that was the only thing they had in common. Io was so close to Lucifer that it took less than two days to race around its orbit, and showed visible movement even in a matter of minutes. Callisto, at over four times Io's distance, required two Mede days - or sixteen Earth ones - to complete its leisurely circuit.

The physical contrast between the two worlds was even more remarkable. Deep-frozen Callisto had been almost unchanged by Jupiter's conversion into a mini-sun: it was still a wasteland of shallow ice craters, so closely packed that there was not a single spot on the entire satellite that had escaped from multiple impacts, in the days when Jupiter's enormous gravity field was competing with Saturn's to gather up the debris of the outer Solar System. Since then, apart from a few stray shots, nothing had happened for several billion years.

On Io, something was happening every week. As a local wit had remarked, before the creation of Lucifer it had been Hell - now it was Hell warmed up.

Often, Poole would zoom into that burning landscape and look into the sulphurous throats of volcanoes that were continually reshaping an area larger than Africa. Sometimes incandescent fountains would soar briefly hundreds of kilometres into space, like gigantic trees of fire growing on a lifeless world.

As the floods of molten sulphur spread out from volcanoes and vents, the versatile element changed through a narrow spectrum of reds and oranges and yellows when, chameleon-like, it was transformed into its vari-coloured allotropes. Before the dawn of the Space Age, no one had ever imagined that such a world existed. Fascinating though it was to observe it from his comfortable vantage point, Poole found it hard to believe that men had ever risked landing there, where even robots feared to tread... His main interest, however, was Europa, which at its closest appeared almost exactly the same size as Earth's solitary Moon, but raced through its phases in only four days. Though Poole had been quite unconscious of the symbolism when he chose his private landscape, it now seemed wholly appropriate that Europa should hang in the sky above another great enigma - the Sphinx.

Even with no magnification, when he requested the naked-eye view, Poole could see how greatly Europa had changed in the thousand years since Discovery had set out for Jupiter. The spider's web of narrow bands and lines that had once completely enveloped the smallest of the four Galilean satellites had vanished, except around the poles. Here the global crust of kilometre-thick ice remained unmelted by the warmth of Europa's new sun: elsewhere, virgin oceans seethed and boiled in the thin atmosphere, at what would have been comfortable room temperature on Earth.

It was also a comfortable temperature to the creatures who had emerged, after the melting of the unbroken ice shield that had both trapped and protected them. Orbiting spysats, showing details only centimetres across, had watched one Europan species starting to evolve into an amphibious stage: though they still spent much of their time underwater, the 'Europs' had even begun the construction of simple buildings.

That this could happen in a mere thousand years was astonishing, but no one doubted that the explanation lay in the last and greatest of the Monoliths - the many-kilometre-long 'Great Wall' standing on the shore of the Sea of Galilee.

And no one doubted that, in its own mysterious way, it was watching over the experiment it had started on this world - as it had done on Earth four million years before.

19
The Madness of Mankind

MISS PRINGLE

FILE INDRA

My dear Indra - sorry I've not even voice-mailed you before - usual excuse, of course, so I won't bother to give it.

To answer your question - yes, I'm now feeling quite at home at the Grannymede, but am spending less and less time there, though I've been enjoying the sky display I've had piped into my suite. Last night the Io flux-tube put on a fine performance - that's a kind of lightning discharge between Io and Jupiter - I mean Lucifer. Rather like Earth's aurora, but much more spectacular. Discovered by the radio astronomers even before I was born.

And talking about ancient times - did you know that Anubis has a Sheriff? I think that's overdoing the frontier spirit. Reminds me of the stories my grandfather used to tell me about Arizona... Must try some of them on the Medes...

This may sound silly - I'm still not used to being in the Bowman Suite. I keep looking over my shoulder...

How do I spend my time? Much the same as in Africa Tower. I'm meeting the local intelligentsia, though as you might expect they're rather thin on the ground (hope no one is bugging this). And I've interacted - real and virtual - with the educational system - very good, it seems, though more technically oriented than you'd approve. That's inevitable, of course, in this hostile environment...

But it's helped me to understand why people live here. There's a challenge - a sense of purpose, if you like - that I seldom found on Earth.

It's true that most of the Medes were born here, so don't know any other home. Though they're - usually - too polite to say so, they think that the Home Planet is becoming decadent. Are you? And if so, what are you Terries - as the

locals call you - going to do about it? One of the teenage classes I've met hopes to wake you up. They're drawing up elaborate Top Secret plans for the Invasion of Earth. Don't say I didn't warn you...

I've made one trip outside Anubis, into the so-called Night Land, where they never see Lucifer. Ten of us -Chandler, two of Goliath's crew, six Medes - went into Farside, and chased the Sun down to the horizon so it really was night. Awesome - much like polar winters on Earth, but with the sky completely black... almost felt I was in space.

We could see all the Galileans beautifully, and watched Europa eclipse - sorry, occult - Io. Of course, the trip had been timed so we could observe this...

Several of the smaller satellites were just also visible, but the double star Earth-Moon was much more conspicuous. Did I feel homesick? Frankly, no - though I miss my new friends back there...

And I'm sorry - I still haven't met Dr Khan, though he's left several messages for me. I promise to do it in the next few days - Earth days, not Mede ones!

Best wishes to Joe - regards to Danil, if you know what's happened to him - is he a real person again? - and my love to yourself.

STORE TRANSMIT

Back in Poole's century, a person's name often gave a clue to his/her appearance, but that was no longer true thirty generations later. Dr Theodore Khan turned out to be a Nordic blond who might have looked more at home in a Viking longboat than ravaging the steppes of Central Asia: however, he would not have been too impressive in either role, being less than a hundred and fifty centimetres tall. Poole could not resist a little amateur psychoanalysis: small people were often aggressive over-achievers - which, from Indra Wallace's hints, appeared to be a good description of Ganymede's sole resident philosopher. Khan probably needed these qualifications, to survive in such a practically-minded society.

Anubis City was far too small to boast a university campus - a luxury which still existed on the other worlds, though many believed that the telecommunications revolution had made it obsolete. Instead, it had something much more appropriate, as well as centuries older - an Academy, complete with a grove of olive trees that would have fooled Plato himself, until he had attempted to walk through it. Indra's joke about departments of philosophy requiring no more equipment than blackboards clearly did not apply in this sophisticated environment.

'It's built to hold seven people,' said Dr Khan proudly, when they had settled down on chairs obviously designed to be not-too-comfortable, 'because that's the maximum one can efficiently interact with. And, if you count the ghost of Socrates, it was the number present when Phaedo delivered his famous address...'

'The one on the immortality of the soul?'

Khan was so obviously surprised that Poole could not help laughing.

'I took a crash course in philosophy just before I graduated - when the syllabus was planned, someone decided that we hairy-knuckled engineers should be exposed to a little culture.'

'I'm delighted to hear it. That makes things so much easier. You know - I still can't credit my luck. Your arrival here almost tempts me to believe in miracles! I'd even thought of going to Earth to meet you - has dear Indra told you about my - ah - obsession?'

'No,' Poole answered, not altogether truthfully.

Dr Khan looked very pleased; he was clearly delighted to find a new audience.

'You may have heard me called an atheist, but that's not quite true. Atheism is unprovable, so uninteresting. Equally, however unlikely it is, we can never be certain that God once existed - and has now shot off to infinity, where no one can ever find him... Like Gautama Buddha, I take no position on this subject. My field of interest is the psychopathology known as Religion.'

'Psychopathology? That's a harsh judgement.'

'Amply justified by history. Imagine that you're an intelligent extraterrestrial, concerned only with verifiable truths. You discover a species which has divided itself into thousands - no by now millions - of tribal groups holding an incredible variety of beliefs about the origin of the universe and the way to behave in it. Although many of them have ideas in common, even when there's a ninety-nine per cent overlap, the remaining one per cent is enough to set them killing and torturing each other, over trivial points of doctrine, utterly meaningless to outsiders.'

'How to account for such irrational behaviour? Lucretius hit it on the nail when he said that religion was the by-product of fear - a reaction to a mysterious and often hostile universe. For much of human prehistory, it may have been a necessary evil - but why was it so much more evil than necessary - and why did it survive when it was no longer necessary?

'I said evil - and I mean it, because fear leads to cruelty. The slightest knowledge of the Inquisition makes one ashamed to belong to the human species... One of the most revolting books ever published was the Hammer of Witches, written by a couple of sadistic perverts and describing the tortures the Church authorized - encouraged! - to extract "confessions" from thousands of harmless old women, before it burned them alive... The Pope himself wrote an approving foreword!'

'But most of the other religions, with a few honourable exceptions, were just as bad as Christianity... Even in your century, little boys were kept chained and whipped until they'd memorized whole volumes of pious gibberish, and robbed of their childhood and manhood to become monks...'

'Perhaps the most baffling aspect of the whole affair is how obvious madmen, century after century, would proclaim that they - and they alone! - had received messages from God. If all the messages had agreed, that would have settled the matter. But of course they were wildly discordant - which never prevented self-styled messiahs from gathering hundreds - sometimes millions - of adherents, who

would fight to the death against equally deluded believers of a microscopically differing faith.'

Poole thought it was about time he got a word in edgeways.

'You've reminded me of something that happened in my home-town when I was a kid. A holy man - quote, unquote - set up shop, claimed he could work miracles - and collected a crowd of devotees in next to no time. And they weren't ignorant or illiterate; often they came from the best families. Every Sunday I used to see expensive cars parked round his - ah - temple.'

'The "Rasputin Syndrome", it's been called: there are millions of such cases, all through history, in every country. And about one time in a thousand the cult survives for a couple of generations. What happened in this case?'

'Well, the competition was very unhappy, and did its best to discredit him. Wish I could remember his name - he used a long Indian one - Swami something-or-other - but it turned out he came from Alabama. One of his tricks was to produce holy objects out of thin air, and hand them to his worshippers. As it happened, our local rabbi was an amateur conjuror, and gave public demonstrations showing exactly how it was done. Didn't make the slightest difference - the faithful said that their man's magic was real, and the rabbi was just jealous.'

'At one time, I'm sorry to say, Mother took the rascal seriously - it was soon after Dad had run off, which may have had something to do with it - and dragged me to one of his sessions. I was only about ten, but I thought I'd never seen anyone so unpleasant-looking. He had a beard that could have held several birds' nests, and probably did.'

'He sounds like the standard model. How long did he flourish?'

'Three or four years. And then he had to leave town in a hurry: he was caught running teenage orgies. Of course, he claimed he was using mystical soul-saving techniques. And you won't believe this -,

'Try me.'

'Even then, lots of his dupes still had faith in him. Their god could do no wrong, so he must have been framed.'

'Framed?'

'Sorry - convicted by faked evidence - sometimes used by the police to catch criminals, when all else fails.'

'Hmm. Well, your swami was perfectly typical: I'm rather disappointed. But he does help to prove my case -that most of humanity has always been insane, at least some of the time.'

'Rather an unrepresentative sample - one small Flagstaff suburb.'

'True, but I could multiply it by thousands - not only in your century, but all down the ages. There's never been anything, however absurd, that countless people weren't prepared to believe, often so passionately that they'd fight to the death rather than abandon their illusions. To me, that's a good operational definition of insanity.'

'Would you argue that anyone with strong religious beliefs was insane?'

'In a strictly technical sense, yes - if they really were sincere, and not hypocrites. As I suspect ninety per cent were.'

'I'm certain that Rabbi Berenstein was sincere - and he was one of the sanest men I ever knew, as well as one of the finest. And how do you account for this? The only real genius I ever met was Dr Chandra, who led the HAL project. I once had to go into his office - there was no reply when I knocked, and I thought it was unoccupied.'

'He was praying to a group of fantastic little bronze statues, draped with flowers. One of them looked like an elephant... another had more than the regular number of arms... I was quite embarrassed, but luckily he didn't hear me and I tiptoed out. Would you say he was insane?'

'You've chosen a bad example: genius often is! So let's say: not insane, but mentally impaired, owing to childhood conditioning. The Jesuits claimed: "Give me a boy for six years, and he is mine for life." If they'd got hold of little Chandra in time, he'd have been a devout Catholic - not a Hindu.'

'Possibly. But I'm puzzled - why were you so anxious to meet me? I'm afraid I've never been a devout anything. What have I got to do with all this?'

Slowly, and with the obvious enjoyment of a man unburdening himself of a heavy, long-hoarded secret, Dr Khan told him.

20
Apostate

RECORD POOLE

Hello, Frank... So you've finally met Ted. Yes, you could call him a crank - if you define that as an enthusiast with no sense of humour. But cranks often get that way because they know a Big Truth - can, you hear my capitals?

- and no one will listen... I'm glad you did - and I suggest you take him quite seriously.

You said you were surprised to see a Pope's portrait prominently displayed in Ted's apartment. That would have been his hero, Pius XX - I'm sure I mentioned him to you. Look him up - he's usually called the Impius! It's a fascinating story, and exactly parallels something that happened just before you were born. You must know how Mikhail Gorbachev, the President of the Soviet Empire, brought about its dissolution at the end of the twentieth century, by exposing its crimes and excesses.

He didn't intend to go that far - he'd hoped to reform it, but that was no longer possible. We'll never know if Pius XX had the same idea, because he was assassinated by a demented cardinal soon after he'd horrified the world by releasing the secret files of the Inquisition...

The religious were still shaken by the discovery of TMA ZERO only a few decades earlier - that had a great impact on Pius XX, and certainly influenced his actions...

But you still haven't told me how Ted, that old cryptoDeist, thinks you can help him in his search for God. I believe he's still mad at him for hiding so successfully. Better not say I told you that.

On second thoughts, why not?

Love - Indra.

STORE

TRANSMIT

MISS PRINGLE

RECORD

Hello - Indra - I've had another session with Dr Ted, though I've still not told him just why you think he's angry with God!

But I've had some very interesting arguments - no, dialogues - with him, though he does most of the talking. Never thought I'd get into philosophy again after all these years of engineering. Perhaps I had to go through them first, to appreciate it. Wonder how he'd grade me as a student?

Yesterday I tried this line of approach, to see his reaction. Perhaps it's original, though I doubt it. Thought you'd like to hear it - will be interested in your comments. Here's our discussion -MISS PRINGLE COPY AUDIO 94.

'Surely, Ted, you can't deny that most of the greatest works of human art have been inspired by religious devotion. Doesn't that prove something?'

'Yes - but not in a way that will give much comfort to any believers! From time to time, people amuse themselves making lists of the Biggests and Greatests and Bests - I'm sure that was a popular entertainment in your day.'

'It certainly was.'

'Well, there have been some famous attempts to do this with the arts. Of course such lists can't establish absolute - eternal - values, but they're interesting and show how tastes change from age to age.'

'The last list I saw - it was on the Earth Artnet only a few years ago - was divided into Architecture, Music, Visual Arts... I remember a few of the examples... the Parthenon, the Taj Mahal... Bach's Toccata and Fugue was first in music, followed by Verdi's Requiem Mass. In art - the Mona Lisa, of course. Then - not sure of the order - a group of Buddha statues somewhere in Ceylon, and the golden death-mask of young King Tut.

'Even if I could remember all the others - which of course I can't - it doesn't matter: the important thing is their cultural and religious backgrounds. Overall, no single religion dominated - except in music. And that could be due

to a purely technological accident: the organ and the other pre-electronic musical instruments were perfected in the Christianized West. It could have worked out quite differently... if, for example, the Greeks or the Chinese had regarded machines as something more than toys.

'But what really settles the argument, as far as I'm concerned, is the general consensus about the single greatest work of human art. Over and over again, in almost every listing - it's Angkor Wat. Yet the religion that inspired that has been extinct for centuries - no one even knows precisely what it was, except that it involved hundreds of gods, not merely one!'

'Wish I could have thrown that at dear old Rabbi Berenstein - I'm sure he'd have had a good answer.'

'I don't doubt it. I wish I could have met him myself. And I'm glad he never lived to see what happened to Israel.'

END AUDIO.

There you have it, Indra. Wish the Grannymede had Angkor Wat on its menu - I've never seen it - but you can't have everything...

Now, the question you really wanted answered... why is Dr Ted so delighted that I'm here?

As you know, he's convinced that the key to many mysteries lies on Europa - where no one has been allowed to land for a thousand years.

He thinks I may be an exception. He believes I have a friend there. Yes - Dave Bowman, or whatever he's now become...

We know that he survived being drawn into the Big Brother Monolith - and somehow revisited Earth afterwards. But there's more, that I didn't know. Very few people do, because the Medes are embarrassed to talk about it...

Ted Khan has spent years collecting the evidence, and is now quite certain of the facts - even though he can't explain them. On at least six occasions, about a century apart, reliable observers here in Anubis have reported seeing an - apparition - just like the one that Heywood Floyd met aboard Discovery. Though not one of them knew about that incident, they were all able to identify Dave when they were shown his hologram. And there was another sighting aboard a survey ship that made a close approach to Europa, six hundred years ago...

Individually, no one would take these cases seriously - but altogether they make a pattern. Ted's quite sure that Dave Bowman survives in some form, presumably associated with the Monolith we call the Great Wall. And he still has some interest in our affairs.

Though he's made no attempt at communication, Ted hopes we can make contact. He believes that I'm the only human who can do it...

I'm still trying to make up my mind. Tomorrow, I'll talk it over with Captain Chandler. Will let you know what we decide. Love, Frank.

STORE

TRANSMIT INDRA

21
Quarantine

'Do you believe in ghosts, Dim?'

'Certainly not: but like every sensible man, I'm afraid of them. Why do you ask?'

'If it wasn't a ghost, it was the most vivid dream I've ever had. Last night I had a conversation with Dave Bowman.'

Poole knew that Captain Chandler would take him seriously, when the occasion required; nor was he disappointed.

'Interesting - but there's an obvious explanation. You've been living here in the Bowman Suite, for Deus's sake! You told me yourself it feels haunted.'

'I'm sure - well, ninety-nine per cent sure - that you're right, and the whole thing was prompted by the discussions I've been having with Prof. Ted. Have you heard the reports that Dave Bowman occasionally appears in Anubis? About once every hundred years? Just as he did to Dr Floyd aboard Discovery, after she'd been reactivated.'

'What happened there? I've heard vague stories, but never taken them seriously.'

'Dr Khan does - and so do I - I've seen the original recordings. Floyd's sitting in my old chair when a kind of dust-cloud forms behind him, and shapes itself into Dave - though only the head has detail. Then it gives that famous message, warning him to leave.'

'Who wouldn't have? But that was a thousand years ago. Plenty of time to fake it.'

'What would be the point? Khan and I were looking at it yesterday. I'd bet my life it's authentic.'

'As a matter of fact, I agree with you. And I have heard those reports...'

Chandler's voice trailed away, and he looked slightly embarrassed.

'Long time ago, I had a girl-friend here in Anubis. She told me that her grandfather had seen Bowman. I laughed.'

'I wonder if Ted has that sighting on his list. Could you put him in touch with your friend?'

'Er - rather not. We haven't spoken for years. For all I know, she may be on the Moon, or Mars... Anyway, why is Professor Ted interested?'

'That's what I really wanted to discuss with you.'

'Sounds ominous. Go ahead,'

'Ted thinks that Dave Bowman - or whatever he's become - may still exist - up there on Europa.'

'After a thousand years?'

'Well - look at me.'

'One sample is poor statistics, my maths prof. used to say. But go on.'

'It's a complicated story - or maybe a jigsaw, with most of the pieces missing. But it's generally agreed that something crucial happened to our ancestors when that Monolith appeared in Africa, four million years ago. It marks a turning point in prehistory - the first appearance of tools - and weapons - and religion... That can't be pure coincidence. The Monolith must have done something to us - surely it couldn't have just stood there, passively accepting worship...'

'Ted's fond of quoting a famous palaeontologist who said "TMA ZERO gave us an evolutionary kick in the pants". He argues that the kick wasn't in a wholly desirable direction. Did we have to become so mean and nasty to survive? Maybe we did... As I understand him, Ted believes that there's something fundamentally wrong with the wiring of our brains, which makes us incapable of consistent logical thinking. To make matters worse, though all creatures need a certain amount of aggressiveness to survive, we seem to have far more than is absolutely necessary. And no other animal tortures its fellows as we do. Is this an evolutionary accident - a piece of genetic bad luck?

'It's also widely agreed that TMA ONE was planted on the Moon to keep track of the project - experiment - whatever it was - and to report to Jupiter - the obvious place for Solar System Mission Control. That's why another Monolith - Big Brother - was waiting there. Had been waiting four million years, when Discovery arrived. Agreed so far?'

'Yes; I've always thought that was the most plausible theory.'

'Now for the more speculative stuff. Bowman was apparently swallowed up by Big Brother, yet something of his personality seems to have survived. Twenty years after that encounter with Heywood Floyd in the second Jupiter expedition, they had another contact aboard Universe, when Floyd joined it for the 2061 rendezvous with Halley's Comet. At least, so he tells us in his memoirs - though he was well over a hundred when he dictated them.'

'Could have been senile.'

'Not according to all the contemporary accounts! Also - perhaps even more significant - his grandson Chris had some equally weird experiences when Galaxy made its forced landing on Europa. And, of course, that's where the Monolith - or a Monolith - is, right now! Surrounded by Europans...'

'I'm beginning to see what Dr Ted's driving at. This is where we came in - the whole cycle's starting over again. The Europs are being groomed for stardom.'

'Exactly - everything fits. Jupiter ignited to give them a sun, to thaw out their frozen world. The warning to us to keep our distance - presumably so that we wouldn't interfere with their development...'

'Where have I heard that idea before? Of course, Frank - it goes back a thousand years - to your own time! "The Prime Directive"! We still get lots of laughs from those old Star Trek programmes.'

'Did I ever tell you I once met some of the actors? They would have been surprised to see me now... And I've always had two thoughts about that non-interference policy. The Monolith certainly violated it with us, back there in Africa. One might argue that did have disastrous results...'

'So better luck next time - on Europa!' Poole laughed, without much humour. 'Khan used those exact words.'

'And what does he think we should do about it? Above all - where do you come into the picture?'

'First of all, we must find what's really happening on Europa - and why. Merely observing it from space is not enough.'

'What else can we do? All the probes the Medes have sent there were blown up, just before landing.'

'And ever since the mission to rescue Galaxy, crew-carrying ships have been diverted by some field of force, which no one can figure out. Very interesting: it proves that whatever is down there is protective, but not malevolent. And - this is the important point - it must have some way of scanning what's on the way. It can distinguish between robots and humans.'

'More than I can do, sometimes. Go on.'

'Well, Ted thinks there's one human being who might make it down to the surface of Europa - because his old friend is there, and may have some influence with the 'powers-that-be.'

Captain Dimitri Chandler gave a long, low whistle.

'And you're willing to risk it?'

'Yes: what have I got to lose?'

'One valuable shuttle craft, if I know what you have in mind. Is that why you've been learning to fly Falcon?'

'Well, now that you mention it... the idea had occurred to me.'

'I'll have to think it over - I'll admit I'm intrigued, but there are lots of problems.'

'Knowing you, I'm sure they won't stand in the way - once you've decided to help me.'

Venture

MISS PRINGLE LIST PRIORITY MESSAGES FROM EARTH

RECORD

Dear Indra - I'm not trying to be dramatic, but this may be my last message from Ganymede. By the time you receive it, I will be on my way to Europa.

Though it's a sudden decision - and no one is more surprised than I am - I've thought it over very carefully. As you'll have guessed, Ted Khan is largely responsible... let him do the explaining, if I don't come back. Please don't misunderstand me - in no way do I regard this as a suicide mission! But I'm ninety per cent convinced by Ted's arguments, and he's aroused my curiosity so much that I'd never forgive myself if I turned down this once-in-a-lifetime opportunity. Maybe I should say once in two lifetimes...

I'm flying Goliath's little one-person shuttle Falcon - how I'd have loved to demonstrate her to my old colleagues back at the Space Administration! Judging by past records, the most likely outcome is that I'll be diverted away from Europa before I can land. Even this will teach me something...

And if it - presumably the local Monolith, the Great Wall - decides to treat me like the robot probes it's zapped in the past, I'll never know. That's a risk I'm prepared to take.

Thank you for everything, and my very best to Joe. Love from Ganymede - and soon, I hope, from Europa.

STORE

TRANSMIT

IV
THE KINGDOM OF SULPHUR

23
Falcon

'Europa's about four hundred thousand kay from Ganymede at the moment,' Captain Chandler informed Poole.

'If you stepped on the gas - thanks for teaching me that phrase! - Falcon could get you there in an hour. But I wouldn't recommend it: our mysterious friend might be alarmed by anyone coming in that fast.'

'Agreed and I want time to think. I'm going to take several hours, at least. And I'm still hoping...' Poole's voice trailed off into silence.

'Hoping what?'

'That I can make some sort of contact with Dave, or whatever it is, before I attempt to land.'

'Yes, it's always rude to drop in uninvited - even with people you know, let alone perfect strangers like the Europs. Perhaps you should take some gifts - what did the old-time explorers use? I believe mirrors and beads were once popular.'

Chandler's facetious tone did not disguise his real concern, both for Poole and for the valuable piece of equipment he proposed to borrow - and for which the skipper of Goliath was ultimately responsible.

'I'm still trying to decide how we work this. If you come back a hero, I want to bask in your reflected glory. But if you lose Falcon as well as yourself, what shall I say? That you stole the shuttle while we weren't looking? I'm afraid no one would buy that story. Ganymede Traffic Control's very efficient - has to be! If you left without advance notice, they'd be on to you in a microsec - well, a millisecond. No way you could leave unless I file your flight-plan ahead of time.'

'So this is what I propose to do, unless I think of something better.'

'You're taking Falcon out for a final qualification test - everyone knows you've already soloed. You'll go into a two-thousand-kilometre-high orbit above Europa - nothing unusual about that - people do it all the time, and the local authorities don't seem to object.'

'Estimated total flight time five hours plus or minus ten minutes. If you suddenly change your mind about coming home, no one can do anything about it - at least, no one on Ganymede. Of course, I'll make some indignant noises, and say how astonished I am by such gross navigational errors, etc., etc. Whatever will look best in the subsequent Court of Enquiry.'

'Would it come to that? I don't want to do anything that will get you into trouble.'

'Don't worry - it's time there was a little excitement round here. But only you and I know about this plot; try not to mention it to the crew - I want them to have - what was that other useful expression you taught me? - "plausible deniability".'

'Thanks, Dim - I really appreciate what you're doing. And I hope you'll never have to regret hauling me aboard Goliath, out round Neptune.'

Poole found it hard to avoid arousing suspicion, by the way he behaved towards his new crewmates as they prepared Falcon for what was supposed to be a short, routine flight. Only he and Chandler knew that it might be nothing of the kind.

Yet he was not heading into the totally unknown, as he and Dave Bowman had done a thousand years ago. Stored in the shuttle's memory were high-resolution maps of Europa showing details down to a few metres across. He knew exactly

where he wished to go; it only remained to see if he would be allowed to break the centuries-long quarantine.

24
Escape

'Manual control, please.'

'Are you sure, Frank?'

'Quite sure, Falcon... Thank you.'

Illogical though it seemed, most of the human race had found it impossible not to be polite to its artificial children, however simple-minded they might be. Whole volumes of psychology, as well as popular guides (How Not to Hurt Your Computer's Feelings; Artificial Intelligence - Real irritation were two of the best-known titles) had been written on the subject of Man-Machine etiquette. Long ago it had been decided that, however inconsequential rudeness to robots might appear to be, it should be discouraged. All too easily, it could spread to human relationships as well.

Falcon was now in orbit, just as her flight-plan had promised, at a safe two thousand kilometres above Europa. The giant moon's crescent dominated the sky ahead, and even the area not illuminated by Lucifer was so brilliantly lit by the much more distant Sun that every detail was clearly visible. Poole needed no optical aid to see his planned destination, on the still-icy shore of the Sea of Galilee, not far from the skeleton of the first spacecraft to land on this world. Though the Europans had long ago removed all its metal components, the ill-fated Chinese ship still served as a memorial to its crew; and it was appropriate that the only 'town' - even if an alien one - on this whole world should have been named 'Tsienville'.

Poole had decided to come down over the Sea, and then fly very slowly towards Tsienville - hoping that this approach would appear friendly, or at least non-aggressive. Though he admitted to himself that this was very naïve, he could think of no better alternative.

Then, suddenly, just as he was dropping below the thousand-kilometre level, there was an interruption - not of the kind he had hoped for, but one which he had been expecting.

'This is Ganymede Control calling Falcon. You have departed from your flight-plan. Please advise immediately what is happening.'

It was hard to ignore such an urgent request, but in the circumstances it seemed the best thing to do.

Exactly thirty seconds later, and a hundred kilometres closer to Europa, Ganymede repeated its message. Once again Poole ignored it - but Falcon did not.

'Are you quite sure you want to do this, Frank?' asked the shuttle. Though Poole knew perfectly well that he was imagining it, he would have sworn there was a note of anxiety in its voice.

'Quite sure, Falcon. I know exactly what I'm doing.'

That was certainly untrue, and any moment now further lying might be necessary, to a more sophisticated audience.

Seldom-activated indicator lights started to flash near the edge of the control board. Poole smiled with satisfaction: everything was going according to plan.

'This is Ganymede Control! Do you receive me, Falcon? You are operating on manual override, so I am unable to assist you. What is happening? You are still descending towards Europa. Please acknowledge immediately.'

Poole began to experience mild twinges of conscience. He thought he recognized the Controller's voice, and was almost certain that it was a charming lady he had met at a reception given by the Mayor, soon after his arrival at Anubis. She sounded genuinely alarmed.

Suddenly, he knew how to relieve her anxiety - as well as to attempt something which he had previously dismissed as altogether too absurd. Perhaps, after all, it was worth a try: it certainly wouldn't do any harm - and it might even work.

'This is Frank Poole, calling from Falcon. I am perfectly OK - but something seems to have taken over the controls, and is bringing the shuttle down towards Europa. I hope you are receiving this - I will continue to report as long as possible.'

Well, he hadn't actually lied to the worried Controller, and one day he hoped he would be able to face her with a clear conscience.

He continued to talk, trying to sound as if he was completely sincere, instead of skirting the edge of truth.

'This is Frank Poole aboard the shuttle Falcon, descending towards Europa. I assume that some outside force has taken charge of my spacecraft, and will be landing it safely.'

'Dave - this is your old shipmate Frank. Are you the entity that is controlling me? I have reason to think that you are on Europa.

'If so - I look forward to meeting you - wherever or whatever you are.'

Not for a moment did he imagine there would be any reply: even Ganymede Control appeared to be shocked into silence.

And yet, in a way, he had an answer. Falcon was still being permitted to descend towards the Sea of Galilee.

Europa was only fifty kilometres below; with his naked eyes Poole could now see the narrow black bar where the greatest of the Monoliths stood guard - if indeed it was doing that - on the outskirts of Tsienville.

No human being had been allowed to come so close for a thousand years.

25
Fire in the Deep

For millions of years it had been an ocean world, its hidden waters protected from the vacuum of space by a crust of ice. In most places the ice was kilometres thick, but there were lines of weakness where it had cracked open and torn apart. Then there had been a brief battle between two implacably hostile elements that came into direct contact on no other world in the Solar System, The war between Sea and Space always ended in the same stalemate; the exposed water simultaneously boiled and froze, repairing the armour of ice.

The seas of Europa would have frozen completely solid long ago without the influence of nearby Jupiter. Its gravity continually kneaded the core of the little world; the forces that convulsed Io were also working there, though with much less ferocity. Everywhere in the deep was evidence of that tug-of-war between planet and satellite, in the continual roar and thunder of submarine earthquakes, the shriek of gases escaping from the interior, the infrasonic pressure waves of avalanches sweeping over the abyssal plains. By comparison with the tumultuous ocean that covered Europa, even the noisy seas of Earth were muted.

Here and there, scattered over the deserts of the deep, were oases that would have amazed and delighted any terrestrial biologist. They extended for several kilometres around tangled masses of pipes and chimneys deposited by mineral brines gushing from the interior. Often they created natural parodies of Gothic castles, from which black, scalding liquids pulsed in a slow rhythm, as if driven by the beating of some mighty heart. And like blood, they were the authentic sign of life itself.

The boiling fluids drove back the deadly cold leaking down from above, and formed islands of warmth on the sea-bed. Equally important, they brought from Europa's interior all the chemicals of life. Such fertile oases, offering food and energy in abundance, had been discovered by the twentieth-century explorers of Earth's oceans. Here they were present on an immensely larger scale, and in far greater variety.

Delicate, spidery structures that seemed to be the analogue of plants flourished in the 'tropical' zones closest to the sources of heat. Crawling among these were bizarre slugs and worms, some feeding on the plants, others obtaining their food directly from the mineral-laden waters around them. At greater distances from the submarine fires around which all these creatures warmed themselves lived sturdier, more robust organisms, not unlike crabs or spiders.

Armies of biologists could have spent lifetimes studying one small oasis. Unlike the Palaeozoic terrestrial seas, the Europan abyss was not a stable environment, so evolution had progressed with astonishing speed, producing multitudes of fantastic forms. And all were under the same indefinite stay of execution; sooner or later, each fountain of life would weaken and die, as the forces that powered it moved their focus elsewhere. All across the Europan sea-bed was evidence of such tragedies; countless circular areas were littered with the skeletons and mineral-encrusted remains of dead creatures, where entire chapters of evolution had been deleted from the book of life. Some had left as their only memorial huge, empty shells like convoluted trumpets, larger than a

man. And there were clams of many shapes - bivalves, and even trivalves, as well as spiral stone patterns, many metres across - exactly like the beautiful ammonites that disappeared so mysteriously from Earth's oceans at the end of the Cretaceous Period.

Among the greatest wonders of the Europan abyss were rivers of incandescent lava, pouring from the calderas of submarine volcanoes. The pressure at these depths was so great that the water in contact with the red-hot magma could not flash into steam, so the two liquids co-existed in an uneasy truce.

There, on another world and with alien actors, something like the story of Egypt had been played out long before the coming of Man. As the Nile had brought life to a narrow ribbon of desert, so this river of warmth had vivified the Europan deep. Along its banks, in a band never more than a few kilometres wide, species after species had evolved and flourished and passed away. And some had left permanent monuments.

Often, they were not easy to distinguish from the natural formations around the thermal vents, and even when they were clearly not due to pure chemistry, one would be hard put to decide whether they were the product of instinct or intelligence. On Earth, the termites reared condominiums almost as impressive as any found in the single vast ocean that enveloped this frozen world.

Along the narrow band of fertility in the deserts of the deep, whole cultures and even civilizations might have risen and fallen, armies might have marched - or swum - under the command of Europan Tamberlanes or Napoleons. And the rest of their world would never have known, for all their oases were as isolated from one another as the planets themselves, The creatures who basked in the glow of the lava rivers, and fed around the hot vents, could not cross the hostile wilderness between their lonely islands. If they had ever produced historians and philosophers, each culture would have been convinced that it was alone in the Universe.

Yet even the space between the oases was not altogether empty of life; there were hardier creatures who had dared its rigours. Some were the Europan analogues of fish - streamlined torpedoes, propelled by vertical tails, steered by fins along their bodies. The resemblance to the most successful dwellers in Earth's oceans was inevitable; given the same engineering problems, evolution must produce very similar answers. Witness the dolphin and the shark - superficially almost identical, yet from far distant branches of the tree of life.

There was, however, one very obvious difference between the fish of the Europan seas and those in terrestrial oceans; they had no gills, for there was hardly a trace of oxygen to be extracted from the waters in which they swam. Like the creatures around Earth's own geothermal vents, their metabolism was based on sulphur compounds, present in abundance in this volcanic environment.

And very few had eyes. Apart from the flickering glow of lava outpourings, and occasional bursts of bioluminescence from creatures seeking mates, or hunters questing prey, it was a lightless world.

It was also a doomed one. Not only were its energy sources sporadic and constantly shifting, but the tidal forces that drove them were steadily weakening. Even if they developed true intelligence, the Europans were trapped between fire and ice.

Barring a miracle, they would perish with the final freezing of their little world.

Lucifer had wrought that miracle.

26
Tsienville

In the final moments, as he came in over the coast at a sedate hundred kilometres an hour, Poole wondered if there might be some last-minute intervention. But nothing untoward happened, even when he moved slowly along the black, forbidding face of the Great Wall.

It was the inevitable name for the Europa Monolith as, unlike its little brothers on Earth and Moon, it was lying horizontally, and was more than twenty kilometres long. Although it was literally billions of times greater in volume than TMA ZERO and TMA ONE, its proportions were exactly the same - that intriguing ratio 1:4:9, inspirer of so much numerological nonsense over the centuries.

As the vertical face was almost ten kilometres high, one plausible theory maintained that among its other functions the Great Wall served as a wind-break, protecting Tsienville from the ferocious gales that occasionally roared in from the Sea of Galilee. They were much less frequent now that the climate had stabilized, but a thousand years earlier they would have been a severe discouragement to any life-forms emerging from the ocean.

Though he had fully intended to do so, Poole had never found time to visit the Tycho Monolith - still Top Secret when he had left for Jupiter - and Earth's gravity made its twin at Olduvai inaccessible to him. But he had seen their images so often that they were much more familiar than the proverbial back of the hand (and how many people, he had often wondered, would recognize the backs of their hands?). Apart from the enormous difference in scale, there was absolutely no way of distinguishing the Great Wall from TMA ONE and TMA ZERO - or, for that matter, the 'Big Brother' Monolith that Discovery and the Leonov had encountered orbiting Jupiter.

According to some theories, perhaps crazy enough to be true, there was only one archetypal Monolith, and all the others - whatever their size - were merely projections or images of it. Poole recalled these ideas when he noticed the spotless, unsullied smoothness of the Great Wall's towering ebon face. Surely, after so many centuries in such a hostile environment, it should have collected a few patches of grime! Yet it looked as immaculate as if an army of window-cleaners had just polished every square centimetre.

Then he recalled that although everyone who had ever come to view TMA ONE and TMA ZERO felt an irresistible urge to touch their apparently pristine surfaces, no one had ever succeeded. Fingers - diamond drills - laser knives - all skittered across the Monoliths as if they were coated by an impenetrable film. Or as if - and this was another popular theory - they were not quite in this universe, but somehow separated from it by an utterly impassable fraction of a millimetre.

He made one complete, leisurely circuit of the Great Wall, which remained totally indifferent to his progress. Then he brought the shuttle - still on manual, in case Ganymede Control made any further attempts to 'rescue' him - to the outer limits of Tsienville, and hovered there looking for the best place to land.

The scene through Falcon's small panoramic window was wholly familiar to him; he had examined it so often in Ganymede recordings, never imagining that one day he would be observing it in reality. The Europs, it seemed, had no idea of town planning; hundreds of hemispherical structures were scattered apparently at random over an area about a kilometre across. Some were so small that even human children would feel cramped in them; though others were big enough to hold a large family, none was more than five metres high.

And they were all made from the same material, which gleamed a ghostly white in the double daylight. On Earth, the Esquimaux had found the identical answer to the challenge of their own frigid, materials-poor environment; Tsienville's igloos were also made of ice.

In lieu of streets, there were canals - as best suited creatures who were still amphibious, and apparently returned to the water to sleep. Also, it was believed, to feed and to mate, though neither hypothesis had been proved.

Tsienville had been called 'Venice, made of ice', and Poole had to agree that it was an apt description. However, there were no Venetians in sight; the place looked as if it had been deserted for years.

And here was another mystery; despite the fact that Lucifer was fifty times brighter than the distant Sun, and was a permanent fixture in the sky, the Europs still seemed locked to an ancient rhythm of night and day. They returned to the ocean at sunset, and emerged with the rising of the Sun - despite the fact that the level of illumination had changed by only a few per cent. Perhaps there was a parallel on Earth, where the life cycles of many creatures were controlled as much by the feeble Moon as the far more brilliant Sun.

It would be sunrise in another hour, and then the inhabitants of Tsienville would return to land and go about their leisurely affairs - as by human standards, they certainly were. The sulphur-based biochemistry that powered the Europs was not as efficient as the oxygen-driven one that energized the vast majority of terrestrial animals. Even a sloth could outrun a Europ, so it was difficult to regard them as potentially dangerous. That was the Good News; the Bad News was that even with the best intentions on both sides, attempts at communication would be extremely slow - perhaps intolerably tedious.

It was about time, Poole decided, that he reported back to Ganymede Control. They must be getting very anxious, and he wondered how his co-conspirator, Captain Chandler, was dealing with the situation.

'Falcon calling Ganymede. As you can doubtless see, I have - er - been brought to rest just above Tsienville. There is no sign of hostility, and as it's still solar night here all the Europs are underwater. Will call you again as soon as I'm on the ground.'

Dim would have been proud of him, Poole thought, as he brought Falcon down gently as a snowflake on a smooth patch of ice. He was taking no chances with its stability, and set the inertial drive to cancel all but a fraction of the

shuttle's weight - just enough, he hoped, to prevent it being blown away by any wind.

He was on Europa - the first human in a thousand years. Had Armstrong and Aldrin felt this sense of elation, when Eagle touched down on the Moon? Probably they were too busy checking their Lunar Module's primitive and totally unintelligent systems. Falcon, of course, was doing all this automatically. The little cabin was now very quiet, apart from the inevitable - and reassuring - murmur of well-tempered electronics. It gave Poole a considerable shock when Chandler's voice, obviously pre-recorded, interrupted his thoughts.

'So you made it! Congratulations! As you know, we're scheduled to return to the Belt week after next, but that should give you plenty of time.'

'After five days, Falcon knows what to do. She'll find her way home, with or without you. So good luck!'

MISS PRINGLE

ACTIVATE CRYPTO PROGRAM

STORE

Hello, Dim - thanks for that cheerful message! I feel rather silly using this program - as if I'm a secret agent in one of the spy melodramas that used to be so popular before I was born. Still, it will allow some privacy, which may be useful. Hope Miss Pringle has downloaded it properly... of course, Miss P, I'm only joking!

By the way, I'm getting a barrage of requests from all the news media in the Solar System. Please try to hold them off - or divert them to Dr Ted. He'll enjoy handling them...

Since Ganymede has me on camera all the time, I won't waste breath telling you what I'm seeing. If all goes well, we should have some action in a few minutes - and we'll know if it really was a good idea to let the Europs find me already sitting here peacefully, waiting to greet them when they come to the surface...

Whatever happens, it won't be as big a surprise to me as it was to Dr Chang and his colleagues, when they landed here a thousand years ago! I played his famous last message again, just before leaving Ganymede. I must confess it gave me an eerie feeling - couldn't help wondering if something like that could possibly happen again... wouldn't like to immortalize myself the way poor Chang did...

Of course, I can always lift off if something starts going wrong... and here's an interesting thought that's just occurred to me... I wonder if the Europs have any history - any kind of records... any memory of what happened just a few kilometres from here, a thousand years ago?

...This is Dr Chang, calling from Europa. I hope you cart hear me, especially Dr Floyd - I know you're aboard Leonov... I may not have much time... aiming my suit antenna where I think you are... please relay this information to Earth.

Tsien was destroyed three hours ago. I'm the only survivor. Using my suit radio - no idea if it has enough range, but it's the only chance. Please listen carefully...

THERE IS LIFE ON EUROPA. I repeat: THERE IS LIFE ON EUROPA...

We landed safely, checked all the systems, and ran out the hoses so we could start pumping water into our propellant tanks immediately... just in case we had to leave in a hurry.

Everything was going according to plan... it seemed almost too good to be true. The tanks were half full when Dr Lee and I went out to check the pipe insulation. Tsien stands - stood - about thirty metres from the edge of the Grand Canal. Pipes went directly from it and down through the ice. Very thin - not safe to walk on.

Jupiter was quarter full, and we had five kilowatts of lighting strung up on the ship. She looked like a Christmas tree - beautiful, reflected on the ice...

Lee saw it first - a huge dark mass rising up from the depths. At first we thought it was a school of fish - too large for a single organism - then it started to break through the ice, and began moving towards us.

It looked rather like huge strands of wet seaweed, crawling along the ground. Lee ran back to the ship to get a camera - I stayed to watch, reporting over the radio. The thing moved so slowly I could easily outrun it. I was much more excited than alarmed. Thought I knew what kind of creature it was - I've seen pictures of the kelp forests off California - but I was quite wrong.

I could tell it was in trouble. It couldn't possibly survive at a temperature a hundred and fifty below its normal environment. It was freezing solid as it moved forward -bits were breaking off like glass - but it was still advancing towards the ship, a black tidal wave, slowing down all the time.

I was still so surprised that I couldn't think straight and I couldn't imagine what it was trying to do. Even though it was heading towards Tsien it still seemed completely harmless, like - well, a small forest on the move. I remember smiling - it reminded me of Macbeth's Birnam Wood...

Then I suddenly realized the danger. Even if it was completely inoffensive - it was heavy - with all the ice it was carrying, it must have weighed several tons, even in this low gravity.

And it was slowly, painfully climbing up our landing gear... the legs were beginning to buckle, all in slow motion, like something in a dream - or a nightmare...

Not until the ship started to topple did I realize what the thing was trying to do - and then it was far too late. We could have saved ourselves - if we'd only switched off our lights!

Perhaps it's a phototrope, its biological cycle triggered by the sunlight that filters down through the ice. Or it could have been attracted like a moth to a candle. Our floodlights must have been more brilliant than anything that Europa has ever known, even the Sun itself...

Then the ship crashed. I saw the hull split, a cloud of snowflakes form as moisture condensed. All the lights went out, except for one, swinging back and forth on a cable a couple of metres above the ground.

I don't know what happened immediately after that. The next thing I remember, I was standing under the light, beside the wreck of the ship, with a fine powdering of fresh snow all around me. I could see my footsteps in it very clearly. I must have run there; perhaps only a minute or two had elapsed...

The plant - I still thought of it as a plant - was motionless. I wondered if it had been damaged by the impact; large sections - as thick as a man's arms - had splintered off, like broken twigs.

Then the main trunk started to move again. It pulled away from the hull, and began to crawl towards me. That was when I knew for certain that the thing was light-sensitive: I was standing immediately under the thousand-watt lamp, which had stopped swinging now.

Imagine an oak tree - better still, a banyan with its multiple trunks and roots - flattened out by gravity and trying to creep along the ground. It got to within five metres of the light, then started to spread out until it had made a perfect circle around me. Presumably that was the limit of its tolerance - the point at which photo-attraction turned to repulsion.

After that, nothing happened for several minutes, I wondered if it was dead - frozen solid at last.

Then I saw that large buds were forming on many of the branches. It was like watching a time-lapse film of flowers opening. In fact I thought they were flowers - each about as big as a man's head.

Delicate, beautifully coloured membranes started to unfold. Even then, it occurred to me that no one - no thing - could ever have seen these colours properly, until we brought our lights - our fatal lights - to this world.

Tendrils, stamens, waving feebly... I walked over to the living wall that surrounded me, so that I could see exactly what was happening. Neither then, or at any other time, had I felt the slightest fear of the creature. I was certain that it was not malevolent - if indeed it was conscious at all.

There were scores of the big flowers, in various stages of unfolding. Now they reminded me of butterflies, just emerging from the chrysalis - wings crumpled, still feeble - I was getting closer and closer to the truth.

But they were freezing - dying as quickly as they formed. Then, one after another, they dropped off from the parent buds. For a few moments they flopped around like fish stranded on dry land - and at last I realized exactly what they were. Those membranes weren't petals - they were fins, or their equivalent. This

was the free-swimming larval stage of the creature. Probably it spends much of its life rooted on the sea-bed, then sends these mobile offspring in search of new territory. Just like the corals of Earth's oceans.

I knelt down to get a closer look at one of the little creatures. The beautiful colours were fading now, to a drab brown. Some of the petal-fins had snapped off, becoming brittle shards as they froze. But it was still moving feebly, and as I approached it tried to avoid me. I wondered how it sensed my presence.

Then I noticed that the stamens - as I'd called them -all carried bright blue dots at their tips. They looked like tiny star sapphires - or the blue eyes along the mantle of a scallop - aware of light, but unable to form true images. As I watched, the vivid blue faded, the gems became dull, ordinary stones...

Dr Floyd - or anyone else who is listening - I haven't much more time; my life-support system alarm has just sounded. But I've almost finished.

I knew then what I had to do. The cable to that thousand-watt lamp was hanging almost to the ground. I gave it a few tugs, and the light went out in a shower of sparks.

I wondered whether it was too late. For a few minutes nothing happened. So I walked over to the wall of tangled branches around me - and kicked it.

Slowly, the creature started to unweave itself, and to retreat back to the Canal. I followed it all the way back to the water, encouraging it with more kicks when it slowed down, feeling the fragments of ice crunching all the time beneath my boots... As it neared the Canal, it seemed to gain strength and energy, as if it knew it was approaching its natural home. I wondered if it would survive, to bud again.

It disappeared through the surface, leaving a few last dead larvae on the alien land. The exposed free water bubbled for a few minutes until a scab of protective ice sealed it from the vacuum above. Then I walked back to the ship to see if there was anything to salvage - I don't want to talk about that.

I've only two requests to make, Doctor. When the taxonomists classify this creature , I hope they'll name it after me.

And - when the next ship comes home - ask them to take our bones back to China.

I'll lose power in a few minutes - wish I knew whether anyone was receiving me. Anyway, I'll repeat this message as long as I can...

This is Professor Chang on Europa, reporting the destruction of the spaceship Tsien. We landed beside the Grand Canal and set up our pumps at the edge of the ice -

MISS PRINGLE RECORD

Here comes the Sun! Strange - how quickly it seems to rise, on this slowly turning world! Of course, of course - the disc's so small that the whole of it pops above the horizon in no time... Not that it makes much difference to the light - if you weren't looking in that direction, you'd never notice that there was another sun in the sky.

But I hope the Europs have noticed. Usually it takes them less than five minutes to start coming ashore after the Little Dawn. Wonder if they already know I'm here, and are scared...

No - could be the other way round. Perhaps they're inquisitive - even anxious to see what strange visitor has come to Tsienville... I rather hope so...

Here they come! Hope your spysats are watching - Falcon's cameras recording...

How slowly they move! I'm afraid it's going to be very boring trying to communicate with them... even if they want to talk to me...

Rather like the thing that overturned Tsien, but much smaller... They remind me of little trees, walking on half a dozen slender trunks. And with hundreds of branches, dividing into twigs, which divide again... and again. Just like many of our general-purpose robots... what a long time it took us to realize that imitation humanoids were ridiculously clumsy, and the proper way to go was with myriad of small manipulators! Whenever we invent something clever, we find that Mother Nature's already thought of it...

Aren't the little ones cute - like tiny bushes on the move. Wonder how they reproduce - budding? I hadn't realized how beautiful they are. Almost as colourful as coral reef fish - maybe for the same reasons... to attract mates, or fool predators by pretending to be something else...

Did I say they looked like bushes? Make that rose-bushes - they've actually got thorns! Must have a good reason for them...

I'm disappointed. They don't seem to have noticed me. They'll all heading into town, as if a visiting spacecraft was an everyday occurrence... only a few left... maybe this will work...

I suppose they can detect sound vibrations - most marine creatures can - though this atmosphere may be too thin to carry my voice very far...

FALCON - EXTERNAL SPEAKER...

HELLO, CAN YOU HEAR ME? MY NAME IS FRANK POOLE... AHEM... I COME IN PEACE FOR ALL MANKIND...

Makes me feel rather stupid, but can you suggest anything better? And it will be good for the record...

Nobody's taking the slightest notice. Big ones and little ones, they re all creeping towards their igloos Wonder what they actually do when they get there -

perhaps I should follow. I'm sure it would be perfectly safe - I can move so much faster - I've just had an amusing flashback. All these creatures going in the same direction - they look like the commuters who used to surge back and forth twice a day between home and office, before electronics made it unnecessary. Let's try again, before they all disappear.

HELLO THERE THIS IS FRANK POOLE, A VISITOR FROM PLANET EARTH. CAN YOU HEAR ME?

I HEAR YOU, FRANK. THIS IS DAVE.

29
The Ghosts in the Machine

Frank Poole's immediate reaction was one of utter astonishment, followed by overwhelming joy. He had never really believed that he would make any kind of contact, either with the Europs or the Monolith. Indeed, he had even had fantasies of kicking in frustration against that towering ebon wall and shouting angrily, 'Is there anybody home?'

Yet he should not have been so amazed: some intelligence must have monitored his approach from Ganymede, and permitted him to land. He should have taken Ted Khan more seriously.

'Dave,' he said slowly, 'is that really you?'

Who else could it be? a part of his mind asked. Yet it was not a foolish question. There was something curiously mechanical - impersonal about the voice that came from the small speaker on Falcon's control board.

YES, FRANK. I AM DAVE.

There was a very brief pause: then the same voice continued, without any change of intonation:

HELLO FRANK. THIS IS HAL.

MISS PRINGLE

RECORD

Well - Indra, Dim - I'm glad I recorded all that, otherwise you'd never believe me...

I guess I'm still in a state of shock. First of all, how should I feel about someone who tried to - who did - kill me - even if it was a thousand years ago! But I understand now that Hal wasn't to blame; nobody was. There's a very good piece of advice I've often found useful 'Never attribute to malevolence what is

merely due to incompetence' I can't feel any anger towards a bunch of programmers I never knew, who've been dead for centuries.

I'm glad this is encrypted, as I don't know how it should be handled, and a lot that I tell you may turn out to be complete nonsense. I'm already suffering from information overload, and had to ask Dave to leave me for a while - after all the trouble I've gone through to meet him! But I don't think I hurt his feelings: I m not sure yet if he has any feelings...

What is he - good question! Well, he really is Dave Bowman, but with most of the humanity stripped away - like - ah - like the synopsis of a book or a technical paper. You know how an abstract can give all the basic information but no hint of the author's personality? Yet there were moments when I felt that something of the old Dave was still there. I wouldn't go so far as to say he's pleased to meet me again - moderately satisfied might be more like it... For myself, I'm still very confused. Like meeting an old friend after a long separation, and finding that they're now a different person. Well, it has been a thousand years - and I can't imagine what experiences he's known, though as I'll show you presently, he's tried to share some of them with me.

And Hal - he's here too, without question. Most of the time, there's no way I can tell which of them is speaking to me. Aren't there examples of multiple personalities in the medical records? Maybe it's something like that.

I asked him how this had happened to them both, and he - they - dammit, Halman! - tried to explain. Let me repeat - I may have got it partly wrong, but it's the only working hypothesis I have.

Of course, the Monolith - in its various manifestations - is the key - no, that's the wrong word - didn't someone once say it was a kind of cosmic Swiss Army knife? You still have them, I've noticed, though both Switzerland and its army disappeared centuries ago. It's a general-purpose device that can do anything it wants to. Or was programmed to do...

Back in Africa, four million years ago, it gave us that evolutionary kick in the pants, for better or for worse. Then its sibling on the Moon waited for us to climb out of the cradle. That we've already guessed, and Dave's confirmed it.

I said that he doesn't have many human feelings, but he still has curiosity - he wants to learn. And what an opportunity he's had!

When the Jupiter Monolith absorbed him - can't think of a better word - it got more than it bargained for. Though it used him - apparently as a captured specimen, and a probe to investigate Earth - he's also been using it. With Hal's assistance - and who should understand a super-computer better than another one? - he's been exploring its memory, and trying to find its purpose.

Now, this is something that's very hard to believe. The Monolith is a fantastically powerful machine - look what it did to Jupiter! - but it's no more than that. It's running on automatic - it has no consciousness. I remember once thinking that I might have to kick the Great Wall and shout 'Is there anyone there?' And the correct answer would have to be - no one, except Dave and Hal...

Worse still, some of its systems may have started to fail; Dave even suggests that, in a fundamental way, it's become stupid! Perhaps it's been left on its own for too long - it's time for a service check.

And he believes the Monolith has made at least one misjudgement. Perhaps that's not the right word - it may have been deliberate, carefully considered...

In any event, it's - well, truly awesome, and terrifying in its implications. Luckily, I can show it to you, so you can decide for yourselves. Yes, even though it happened a thousand years ago, when Leonov flew the second mission to Jupiter! And all this time, no one has ever guessed...

I'm certainly glad you got me fitted with the Braincap. Of course it's been invaluable - I can't imagine life without it - but now it's doing a job it was never designed for. And doing it remarkably well.

It took Halman about ten minutes to find how it worked, and to set up an interface. Now we have mind-to-mind contact - which is quite a strain on me, I can tell you. I have to keep asking them to slow down, and use baby-talk. Or should I say baby-think...

I'm not sure how well this will come through. It's a thousand-year-old recording of Dave's own experience, somehow stored in the Monolith's enormous memory, then retrieved by Dave and injected into my Braincap - don't ask me exactly how - and finally transferred and beamed to you by Ganymede Central. Phew. Hope you don't get a headache downloading it.

Over to Dave Bowman at Jupiter, early twenty-first century...

30
Foamscape

The million-kilometre-long tendrils of magnetic force, the sudden explosion of radio waves, the geysers of electrified plasma wider than the planet Earth - they were as real and clearly visible to him as the clouds banding the planet in multi-hued glory. He could understand the complex pattern of their interactions, and realized that Jupiter was much more wonderful than anyone had ever guessed.

Even as he fell through the roaring heart of the Great Red Spot, with the lightning of its continent-wide thunderstorms detonating under him, he knew why it had persisted for centuries though it was made of gases far less substantial than those that formed the hurricanes of Earth. The thin scream of hydrogen wind faded as he sank into the calmer depths, and a sheet of waxen snowflakes - some already coalescing into barely palpable mountains of hydrocarbon foam - descended from the heights above. It was already warm enough for liquid water to exist, but there were no oceans there; this purely gaseous environment was too tenuous to support them.

He descended through layer after layer of cloud, until he entered a region of such clarity that even human vision could have scanned an area more than a thousand kilometres across. It was only a minor eddy in the vaster gyre of the Great Red Spot; and it held a secret that men had long guessed, but never proved. Skirting the foothills of the drifting foam mountains were myriad of small, sharply defined clouds, all about the same size and patterned with similar red and brown mottling. They were small only as compared with the inhuman scale of their surroundings; the very least would have covered a fair-sized city.

They were clearly alive, for they were moving with slow deliberation along the flanks of the aerial mountains, browsing off their slopes like colossal sheep. And they were calling to each other in the metre band, their radio voices faint but clear against the cracklings and concussions of Jupiter itself.

Nothing less than living gasbags, they floated in the narrow zone between freezing heights and scorching depths. Narrow, yes - but a domain far larger than all the biosphere of Earth.

They were not alone. Moving swiftly among them were other creatures so small that they could easily have been overlooked. Some of them bore an almost uncanny resemblance to terrestrial aircraft, and were of about the same size. But they too were alive - perhaps predators, perhaps parasites, perhaps even herdsmen.

A whole new chapter of evolution, as alien as that which he had glimpsed on Europa, was opening before him. There were jet-propelled torpedoes like the squids of the terrestrial oceans, hunting and devouring the huge gas-bags. But the balloons were not defenceless; some of them fought back with electric thunderbolts and with clawed tentacles like kilometre-long chainsaws.

There were even stranger shapes, exploiting almost every possibility of geometry - bizarre, translucent kites, tetrahedra, spheres, polyhedra, tangles of twisted ribbons... The gigantic plankton of the Jovian atmosphere, they were designed to float like gossamer in the uprising currents, until they had lived long enough to reproduce; then they would be swept down into the depths to be carbonized and recycled in a new generation.

He was searching a world more than a hundred times the area of Earth, and though he saw many wonders, nothing there hinted of intelligence. The radio voices of the great balloons carried only simple messages of warning or of fear. Even the hunters, who might have been expected to develop higher degrees of organization, were like the sharks in Earth's oceans - mindless automata.

And for all its breathtaking size and novelty, the biosphere of Jupiter was a fragile world, a place of mists and foam, of delicate silken threads and paper-thin tissues spun from the continual snowfall of petrochemicals formed by lightning in the upper atmosphere. Few of its constructs were more substantial than soap bubbles; its most awesome predators could be torn to shreds by even the feeblest of terrestrial carnivores.

Like Europa, but on a vastly grander scale, Jupiter was an evolutionary cul-de-sac. Intelligence would never emerge here; even if it did, it would be doomed to a stunted existence. A purely aerial culture might develop, but in an environment where fire was impossible, and solids scarcely existed, it could never even reach the Stone Age.

31
Nursery

MISS PRINGLE RECORD

Well, Indra - Dim - I hope that came through in good shape - I still find it hard to believe. All those fantastic creatures - surely we should have detected their radio voices, even if we couldn't understand them! - wiped out in a moment, so that Jupiter could be made into a sun.

And now we can understand why. It was to give the Europs their chance. What pitiless logic: is intelligence the only thing that matters? I can see some long arguments with Ted Khan over this - The next question is: will the Europs make the grade - or will they remain forever stuck in the kindergarten - not even that - the nursery? Though a thousand years is a very short time, one would have expected some progress, but according to Dave they're exactly the same now as when they left the sea. Perhaps that's the trouble; they still have one foot - or one twig! - in the water.

And here's another thing we got completely wrong. We thought they went back into the water to sleep. It's just the other way round - they go back to eat, and sleep when they come on land! As we might have guessed from their structure - that network of branches - they're plankton feeders...

I asked Dave about the igloos they've built. Aren't they a technological advance? And he said: not really - they're only adaptations of structures they make on the sea-bed, to protect themselves from various predators - especially something like a flying carpet, as big as a football field...

There's one area, though, where they have shown initiative - even creativity. They're fascinated by metals, presumably because they don't exist in pure form in the ocean. That's why Tsien was stripped - the same thing's happened to the occasional probes that have come down in their territory. What do they do with the copper and beryllium and titanium they collect? Nothing useful, I'm afraid. They pile it all together in one place, in a fantastic heap that they keep reassembling. They could be developing an aesthetic sense - I've seen worse in the Museum of Modem Art... But I've got another theory - did you ever hear of cargo cults? During the twentieth century, some of the few primitive tribes that still existed made imitation aeroplanes out of bamboo, in the hope of attracting the big birds in the sky that occasionally brought them wonderful gifts. Perhaps the Europs have the same idea.

Now that question you keep asking me... What is Dave? And how did he - and Hal - become whatever it is they are now?

The quick answer, of course, is that they're both emulations - simulations - in the Monolith's gigantic memory. Most of the time they're inactivated; when I asked Dave about this, he said he'd been 'awake' - his actual word -for only fifty years altogether, in the thousand since his - er - metamorphosis.

When I asked if he resented this takeover of his life, he said, 'Why should I resent it? I am performing my functions perfectly.' Yes, that sounds exactly like Hal! But I believe it was Dave - if there's any distinction now.

Remember that Swiss Army knife analogy? Halman is one of this cosmic knife's myriad of components.

But he's not a completely passive tool - when he's awake, he has some autonomy, some independence - presumably within limits set by the Monolith's overriding control. During the centuries, he's been used as a kind of intelligent probe to examine, Jupiter - as you've just seen - as well as Ganymede and the Earth. That confirms those mysterious events in Florida,

reported by Dave's old girl-friend, and the nurse who was looking after his mother, just moments before her death... as well as the encounters in Anubis City.

And it also explains another mystery. I asked Dave directly: why was I allowed to land on Europa, when everyone else has been turned away for centuries? I fully expected to be!

The answer's ridiculously simple. The Monolith uses Dave - Halman - from time to time, to keep an eye on us.

Dave knew all about my rescue - even saw some of the media interviews I made, on Earth and on Ganymede. I must say I'm still a little hurt he made no attempt to contact me! But at least he put out the Welcome mat when I did arrive...

Dim - I still have forty-eight hours before Falcon leaves - with or without me! I don't think I'll need them, now I've made contact with Halman; we can keep in touch just as easily from Anubis... if he wants to do so.

And I'm anxious to get back to the Grannymede as quickly as possible. Falcon's a fine little spacecraft, but her plumbing could be improved - it's beginning to smell in here, and I'm itching for a shower.

Look forward to seeing you - and especially Ted Khan.

We have much to talk about, before I return to Earth.

TRANSMIT

STORE

V
TERMINATION

The toil of all that be
Heals not the primal fault;
It rains into the sea,
And still the sea is salt.
- A. E. Housman, More Poems

32
A Gentleman of Leisure

On the whole, it had been an interesting but uneventful decades, punctuated by the joys and sorrows which Time and Fate bring to all mankind. The greatest of those had been wholly unexpected; in fact, before he left for Ganymede, Poole would have dismissed the very idea as preposterous.

There is much truth in the saying that absence makes the heart grow fonder. When he and Indra Wallace met again, they discovered that, despite their

bantering and occasional disagreements, they were closer than they had imagined. One thing led to another including, to their mutual joy, Dawn Wallace and Martin Poole.

It was rather late in life to start a family - quite apart from that little matter of a thousand years - and Professor Anderson had warned them that it might be impossible. Or even worse...

'You were lucky in more ways than you realize,' he told Poole. 'Radiation damage was surprisingly low, and we were able to make all essential repairs from your intact DNA. But until we do some more tests, I can't promise genetic integrity. So enjoy yourselves - but don't start a family until I give the OK.'

The tests had been time-consuming, and as Anderson had feared, further repairs were necessary. There was one major set-back - something that could never have lived, even if it had been allowed to go beyond the first few weeks after conception - but Martin and Dawn were perfect, with just the right number of heads, arms and legs. They were also handsome and intelligent, and barely managed to escape being spoiled by their doting parents - who continued to be the best of friends when, after fifteen years, each opted for independence again. Because of their Social Achievement Rating, they would have been permitted - indeed, encouraged - to have another child, but they decided not to put any more of a burden on their astonishingly good luck.

One tragedy had shadowed Poole's personal life during this period - and indeed had shocked the whole Solar community. Captain Chandler and his entire crew had been lost when the nucleus of a comet they were reconnoitring exploded suddenly, destroying Goliath so completely that only a few fragments were ever located. Such explosions - caused by reactions among unstable molecules which existed at very low temperatures - were a well-known danger to comet-collectors, and Chandler had encountered several during his career. No one would ever know the exact circumstances which caused so experienced a spaceman to be taken by surprise.

Poole missed Chandler very badly: he had played a unique role in his life, and there was no one to replace him - no one, except Dave Bowman, with whom he had shared so momentous an adventure. He and Chandler had often made plans to go into space together again, perhaps all the way out to the Oort Cloud with its unknown mysteries and its remote but inexhaustible wealth of ice. Yet some conflict of schedules had always upset their plans, so this was a wished-for future that would never exist.

Another long-desired goal Poole had managed to achieve - despite doctor's orders. He had been down to Earth: and once was quite enough.

The vehicle in which he had travelled looked almost identical to the wheelchairs used by the luckier paraplegics of his own time. It was motorized, and had balloon tyres which allowed it to roll over reasonably smooth surfaces. However, it could also fly - at an altitude of about twenty centimetres - on an aircushion produced by a set of small but very powerful fans. Poole was surprised that so primitive a technology was still in use, but inertia-control devices were too bulky for such small-scale applications.

Seated comfortably in his hoverchair, he was scarcely conscious of his increasing weight as he descended into the heart of Africa; though he did notice some difficulty in breathing, he had experienced far worse during his astronaut training. What he was not prepared for was the blast of furnace-heat that smote

him as he rolled out of the gigantic, sky-piercing cylinder that formed the base of the Tower. Yet it was still morning: what would it be like at noon?

He had barely accustomed himself to the heat when his sense of smell was assailed. A myriad odours - none unpleasant, but all unfamiliar - clamoured for his attention. He closed his eyes for a few minutes, in an attempt to avoid overloading his input circuits.

Before he had decided to open them again, he felt some large, moist object palpating the back of his neck.

'Say hello to Elizabeth,' said his guide, a burly young man dressed in traditional Great White Hunter garb, much too smart to have seen any real use: 'she's our official greeter.'

Poole twisted round in his chair, and found himself looking into the soulful eyes of a baby elephant.

'Hello, Elizabeth,' he answered, rather feebly. Elizabeth lifted her trunk in salute, and emitted a sound not usually heard in polite society, though Poole felt sure it was well-intentioned.

Altogether, he spent less than an hour on Planet Earth, skirting the edge of a jungle whose stunted trees compared unfavourably with Skyland's, and encountering much of the local fauna. His guides apologized for the friendliness of the lions, who had been spoilt by tourists - but the malevolent expressions of the crocodiles more than compensated; here was Nature raw and unchanged.

Before he returned to the Tower, Poole risked taking a few steps away from his hoverchair. He realized that this would be the equivalent of carrying his own weight on his back, but that did not seem an impossible feat, and he would never forgive himself unless he attempted it.

It was not a good idea; perhaps he should have tried it in a cooler climate. After no more than a dozen steps, he was glad to sink back into the luxurious clutches of the chair.

'That's enough,' he said wearily. 'Let's go back to the Tower.'

As he rolled into the elevator lobby, he noticed a sign which he had somehow overlooked during the excitement of his arrival. It read:

WELCOME TO AFRICA!
'In wildness is the preservation of the world.'
HENRY DAVID THOREAU
(1817-1862)

Observing Poole's interest, the guide asked 'Did you know him?'

It was the sort of question Poole heard all too often, and at the moment he did not feel equipped to deal with it.

'I don't think so,' he answered wearily, as the great doors closed behind them, shutting out the sights, scents and sounds of Mankind's earliest home.

His vertical safari had satisfied his need to visit Earth, and he did his best to ignore the various aches and pains acquired there when he returned to his apartment at Level 10,000 - a prestigious location, even in this democratic society. Indra, however, was mildly shocked by his appearance, and ordered him straight to bed.

'Just like Antaeus - but in reverse!' she muttered darkly. 'Who?' asked Poole: there were times when his wife's erudition was a little overwhelming, but he had determined never to let it give him an inferiority complex.

'Son of the Earth Goddess, Gaea. Hercules wrestled with him - but every time he was thrown to the ground, Antaeus renewed his strength.'

'Who won?'

'Hercules, of course - by holding Antaeus in the air, so Ma couldn't recharge his batteries.'

'Well, I'm sure it won't take me long to recharge mine. And I've learned one lesson. If I don't get more exercise, I may have to move up to Lunar Gravity level.'

Poole's good resolution lasted a full month: every morning he went for a brisk five-kilometre walk, choosing a different level of the Africa Tower each day. Some floors were still vast, echoing deserts of metal which would probably never be occupied, but others had been landscaped and developed over the centuries in a bewildering variety of architectural styles. Many were borrowings from past ages and cultures; others hinted at futures which Poole would not care to visit. At least there was no danger of boredom, and on many of his walks he was accompanied, at a respectful distance, by small groups of friendly children. They were seldom able to keep up with him for long.

One day, as Poole was striding down a convincing - though sparsely populated - imitation of the Champs Elyse´es, he suddenly spotted a familiar face.

'Danil!' he called.

The other man took not the slightest notice, even when Poole called again, more loudly.

'Don't you remember me?'

Danil - and now that he had caught up with him, Poole did not have the slightest doubt of his identity - looked genuinely baffled.

'I'm sorry,' he said. 'You're Commander Poole, of course. But I'm sure we've never met before.'

Now it was Poole's turn to be embarrassed.

'Stupid of me,' he apologized. 'Must have mistaken you for someone else. Have a good day.'

He was glad of the encounter, and was pleased to know that Danil was back in normal society. Whether his original crime had been axe-murders or overdue library books should no longer be the concern of his one-time employer; the account had been settled, the books closed. Although Poole sometimes missed the cops-and-robbers dramas he had often enjoyed in his youth, he had grown to accept the current wisdom: excessive interest in pathological behaviour was itself pathological.

With the help of Miss Pringle, Mk III, Poole had been able to schedule his life so that there were even occasional blank moments when he could relax and set his Braincap on Random Search, scanning his areas of interest. Outside his immediate family, his chief concerns were still among the moons of Jupiter/Lucifer, not least because he was recognized as the leading expert on the subject, and a permanent member of the Europa Committee.

This had been set up almost a thousand years ago, to consider what, if anything, could and should be done about the mysterious satellite. Over the centuries, it had accumulated a vast amount of information, going all the way back to the Voyager flybys of 1979 and the first detailed surveys from the orbiting Galileo spacecraft of 1996.

Like most long-lived organizations, the Europa Committee had become slowly fossilized, and now met only when there was some new development. It had woken up with a start after Halman's reappearance, and appointed an energetic new chairperson whose first act had been to co-opt Poole.

Though there was little that he could contribute that was not already recorded, Poole was very happy to be on the Committee. It was obviously his duty to make himself available, and it also gave him an official position he would otherwise have lacked. Previously his status was what had once been called a 'national treasure', which he found faintly embarrassing. Although he was glad to be supported in luxury by a world wealthier than all the dreams of war-ravaged earlier ages could have imagined, he felt the need to justify his existence.

He also felt another need, which he seldom articulated even to himself. Halman had spoken to him, if only briefly, at their strange encounter two decades ago. Poole was certain that, if he wished, Halman could easily do so again. Were all human contacts no longer of interest to him? He hoped that was not the case; yet that might be one explanation of his silence.

He was frequently in touch with Theodore Khan - as active and acerbic as ever, and now the Europa Committee's representative on Ganymede. Ever since Poole had returned to Earth, Ted had been trying in vain to open a channel of communication with Bowman. He could not understand why long lists of important questions on subjects of vital philosophical and historic interest received not even brief acknowledgements.

'Does the Monolith keep your friend Halman so busy that he can't talk to me?' he complained to Poole. 'What does he do with his time, anyway?'

It was a very reasonable question; and the answer came, like a thunderbolt out of a cloudless sky, from Bowman himself - as a perfectly commonplace vidphone call.

33
Contact

'Hello, Frank. This is Dave. I have a very important message for you. I assume that you are now in your suite in Africa Tower. If you are there, please identify yourself by giving the name of our instructor in orbital mechanics. I will wait for sixty seconds, and if there is no reply will try again in exactly one hour.'

That minute was hardly long enough for Poole to recover from the shock. He felt a brief surge of delight, as well as astonishment, before another emotion took over. Glad though he was to hear from Bowman again, that phrase 'a very important message' sounded distinctly ominous.

At least it was fortunate, Poole told himself, that he's asked for one of the few names I can remember. Yet who could forget a Scot with a Glasgow accent so thick it had taken them a week to master it? But he had been a brilliant lecturer - once you understood what he was saying.

'Dr Gregory McVitty.'

'Accepted. Now please switch on your Braincap receiver. It will take three minutes to download this message. Do not attempt to monitor: I am using ten-to-one compression. I will wait two minutes before starting.'

How is he managing to do this? Poole wondered. Jupiter/Lucifer was now over fifty light-minutes away, so this message must have left almost an hour ago. It must have been sent with an intelligent agent in a properly addressed package on the Ganymede-Earth beam - but that would have been a trivial feat to Halman, with the resources he had apparently been able to tap inside the Monolith.

The indicator light on the Brainbox was flickering. The message was coming through.

At the compression Halman was using, it would take half an hour for Poole to absorb the message in real-time. But he needed only ten minutes to know that his peaceful life-style had come to an abrupt end

34
Judgement

In a world of universal and instantaneous communication, it was very difficult to keep secrets. This was a matter, Poole decided immediately, for face-to-face discussion.

The Europa Committee had grumbled, but all its members had assembled in his apartment. There were seven of them - the lucky number, doubtless suggested by the phases of the Moon, that had always fascinated Mankind. It was the first time Poole had met three of the Committee's members, though by now he knew them all more thoroughly than he could possibly have done in a pre-Braincapped lifetime.

'Chairperson Oconnor, members of the Committee - I'd like to say a few words - only a few, I promise! - before you download the message I've received from Europa. And this is something I prefer to do verbally; that's more natural for me - I'm afraid I'll never be quite at ease with direct mental transfer.'

'As you all know, Dave Bowman and Hal have been stored as emulations in the Monolith on Europa. Apparently it never discards a tool it once found useful, and from time to time it activates Halman, to monitor our affairs - when they begin to concern it. As I suspect my arrival may have done - though perhaps I flatter myself.'

'But Halman isn't just a passive tool. The Dave component still retains something of its human origins - even emotions. And because we were trained together - shared almost everything for years - he apparently finds it much easier to communicate with me than with anyone else. I would like to think he enjoys doing it, but perhaps that's too strong a word.'

'He's also curious - inquisitive - and perhaps a little resentful of the way he's been collected, like a specimen of wildlife. Though that's probably what we are, from the viewpoint of the intelligence that created the Monolith.'

'And where is that intelligence now? Halman apparently knows the answer, and it's a chilling one.'

'As we always suspected, the Monolith is part of a galactic network of some kind. And the nearest node - the Monolith's controller, or immediate superior - is 450 light-years away.'

'Much too close for comfort! This means that the report on us and our affairs that was transmitted early in the twenty-first century was received half a millennium ago. If the Monolith's - let's say Supervisor - replied at once, any further instructions should be arriving just about now.'

'And that's exactly what seems to be happening. During the last few days, the Monolith has been receiving a continuous string of messages, and has been setting up new programs, presumably in accordance with these.'

'Unfortunately, Halman can only make guesses about the nature of those instructions. As you'll gather when you've downloaded this tablet, he has some limited access to many of the Monolith's circuits and memory banks, and can even carry on a kind of dialogue with it. If that's the right word - since you need two people for that! I still can't really grasp the idea that the Monolith, for all its powers, doesn't possess consciousness - doesn't even know that it exists!'

'Halman's been brooding over the problem for a thousand years - on and off - and has come to the same answer that most of us have done. But his conclusion must surely carry far more weight, because of his inside knowledge.'

'Sorry! I wasn't intending to make a joke - but what else could you call it?'

'Whatever went to the trouble of creating us - or at least tinkering with our ancestors' minds and genes - is deciding what to do next. And Halman is pessimistic. No - that's an exaggeration. Let's say he doesn't think much of our chances, but is now too detached an observer to be unduly worried. The future -

the survival! - of the human race isn't much more than an interesting problem to him, but he's willing to help.'

Poole suddenly stopped talking, to the surprise of his intent audience.

'That's strange. I've just had an amazing flashback... I'm sure it explains what's happening. Please bear with me.'

'Dave and I were walking together one day, along the beach at the Cape, a few weeks before launch, when we noticed a large beetle lying on the sand. As often happens, it had fallen on its back and was waving its legs in the air, struggling to get right-way-up.'

'I ignored it - we were engaged in some complicated technical discussion - but not Dave. He stepped aside, and carefully flipped it over with his shoe. As it flew away I commented, "Are you sure that was a good idea? Now it will go off and chomp somebody's prize chrysanthemums." And he answered, "Maybe you're right. But I'd like to give it the benefit of the doubt."

'My apologies - I'd promised to say only a few words! But I'm very glad I remembered that incident: I really believe it puts Halman's message in the right perspective. He's giving the human race the benefit of the doubt...'

'Now please check your Braincaps. This is a high-density recording - top of the u.v. band, Channel 110. Make yourselves comfortable, but be sure you're free line of sight. Here we go...'

35
Council of War

No one asked for a replay. Once was sufficient.

There was a brief silence when the playback finished; then Chairperson Dr Oconnor removed her Braincap, massaged her shining scalp, and said slowly:

'You taught me a phrase from your period that seems very appropriate now. This is a can of worms.'

'But only Bowman - Halman - has opened it,' said one of the Committee members. 'Does he really understand the operation of something as complex as the Monolith? Or is this whole scenario a figment of his imagination?'

'I don't think he has much imagination,' Dr Oconnor answered. 'And everything checks perfectly. Especially the reference to Nova Scorpio. We assumed that was an accident; apparently it was a - judgement.'

'First Jupiter - now Scorpio,' said Dr Kraussman, the distinguished physicist who was popularly regarded as a reincarnation of the legendary Einstein. A little plastic surgery, it was rumoured, had also helped. 'Who will be next in line?'

'We always guessed,' said the Chair, 'that the TMAs were monitoring us.' She paused for a moment, then added ruefully: 'What bad - what incredibly bad! -

luck that the fmal report went off, just after the very worst period in human history!'

There was another silence. Everyone knew that the twentieth century had often been branded 'The Century of Torture'

Poole listened without interrupting, while he waited for some consensus to emerge. Not for the first time, he was impressed by the quality of the Committee No one was trying to prove a pet theory, score debating points, or inflate an ego: he could not help drawing a contrast with the often bad-tempered arguments he had heard in own time, between Space Agency engineers and administrators, Congressional staffs, and industrial executives.

Yes, the human race had undoubtedly improved. The Braincap had not only helped to weed out misfits, but had enormously increased the efficiency of education. Yet there had also been a loss; there were very few memorable characters in this society. Offhand he could think of only four - Indra, Captain Chandler, Dr Khan and the Dragon Lady of wistful memory.

The Chairperson let the discussion flow smoothly back and forth until everyone had had a say, then began her summing up.

'The obvious first question - how seriously should we take this threat - isn't worth wasting time on. Even if it's a false alarm, or a misunderstanding, it's potentially so grave that we must assume it's real, until we have absolute proof to the contrary. Agreed?'

'Good. And we don't know how much time we have. So we must assume that the danger is immediate. Perhaps Halman may be able to give us some further warning, but by then it may be too late.'

'So the only thing we have to decide is: how can we protect ourselves, against something as powerful as the Monolith? Look what happened to Jupiter! And, apparently, Nova Scorpio...'

'I'm sure that brute force would be useless, though perhaps we should explore that option. Dr Kraussman - how long would it take to build a super-bomb?'

'Assuming that the designs still exist, so that no research is necessary - oh, perhaps two weeks. Thermonuclear weapons are rather simple, and use common materials - after all, they made them back in the Second Millennium! But if you wanted something sophisticated - say an antimatter bomb, or a mini-black-hole - well, that might take a few months.'

'Thank you: could you start looking into it? But as I've said, I don't believe it would work; surely something that can handle such powers must also be able to protect itself against them. So - any other suggestions?'

'Can we negotiate?' one councillor asked, not very hopefully.

'With what... or whom?' Kraussman answered. 'As we've discovered, the Monolith is essentially a pure mechanism, doing just what it's been programmed to do. Perhaps that program is flexible enough to allow of changes, but there's no way we can tell. And we certainly can't appeal to Head Office - that's half a thousand light-years away!'

Poole listened without interrupting; there was nothing he could contribute to the discussion, and indeed much of it was completely over his head. He began to feel an insidious sense of depression, would it have been better, he wondered, not to pass on this information? Then, if it was a false alarm, no one would be any the worse. And if it was not - well, humanity would still have peace of mind, before whatever inescapable doom awaited it.

He was still mulling over these gloomy thoughts when he was suddenly alerted by a familiar phrase.

A quiet little member of the Committee, with a name so long and difficult that Poole had never been able to remember, still less pronounce it, had abruptly dropped just two words into the discussion.

'Trojan Horse!'

There was one of those silences generally described as 'pregnant', then a chorus of 'Why didn't I think of that!' 'Of course!' 'Very good idea!' until the Chairperson, for the first time in the session, had to call for order.

'Thank you, Professor Thirugnanasampanthamoorthy,' said Dr Oconnor, without missing a beat. 'Would you like to be more specific?'

'Certainly. If the Monolith is indeed, as everyone seems to think, essentially a machine without consciousness - and hence with only limited self-monitoring ability - we may already have the weapons that can defeat it. Locked up in the Vault.'

'And a delivery system - Halman!'

'Precisely.'

'Just a minute, Dr T. We know nothing - absolutely nothing - about the Monolith's architecture. How can we be sure that anything our primitive species ever designed would be effective against it?'

'We can't - but remember this. However sophisticated it is, the Monolith has to obey exactly the same universal laws of logic that Aristotle and Boole formulated, centuries ago. That's why it may - no, should! - be vulnerable to the things locked up in the Vault. We have to assemble them in such a way that at least one of them will work. It's our only hope - unless anybody can suggest a better alternative.'

'Excuse me,' said Poole, finally losing patience. 'Will someone kindly tell me - what and where is this famous Vault you're talking about?'

36
Chamber of Horrors

History is full of nightmares, some natural, some manmade.

By the end of the twenty-first century, most of the natural ones - smallpox, the Black Death, AIDS, the hideous viruses lurking in the African jungle - had

been eliminated, or at least brought under control, by the advance of medicine. However, it was never wise to underestimate the ingenuity of Mother Nature, and no one doubted that the future would still have unpleasant biological surprises in store for Mankind.

It seemed a sensible precaution, therefore, to keep a few specimens of all these horrors for scientific study - carefully guarded, of course, so that there was no possibility of them escaping and again wreaking havoc on the human race. But how could one be absolutely sure that there was no danger of this happening?

There had been - understandably - quite an outcry in the late twentieth century when it was proposed to keep the last known smallpox viruses at Disease Control Centres in the United States and Russia. However unlikely it might be, there was a finite possibility that they might be released by such accidents as earthquakes, equipment failures - or even deliberate sabotage by terrorist groups.

A solution that satisfied everyone (except a few 'Preserve the lunar wilderness!' extremists) was to ship them to the Moon, and to keep them in a laboratory at the end of a kilometre-long shaft drilled into the isolated mountain Pico, one of the most prominent features of the Mare Imbrium. And here, over the years, they were joined by some of the most outstanding examples of misplaced human ingenuity - indeed, insanity.

There were gases and mists that, even in microscopic doses, caused slow or instant death. Some had been created by religious cultists who, though mentally deranged, had managed to acquire considerable scientific knowledge. Many of them believed that the end of the world was at hand (when, of course, only their followers would be saved). In case God was absent-minded enough not to perform as scheduled, they wanted to make sure that they could rectify His unfortunate oversight.

The first assaults of these lethal cultists were made on such vulnerable targets as crowded subways, World Fairs, sports stadiums, pop concerts... tens of thousands were killed, and many more injured before the madness was brought under control in the early twenty-first century. As often happens, some good came out of evil, because it forced the world's law-enforcement agencies to co-operate as never before; even rogue states which had promoted political terrorism were unable to tolerate this random and wholly unpredictable variety.

The chemical and biological agents used in these attacks - as well as in earlier forms of warfare - joined the deadly collection in Pico. Their antidotes, when they existed, were also stored with them. It was hoped that none of this material would ever concern humanity again - but it was still available, under heavy guard, if it was needed in some desperate emergency.

The third category of items stored in the Pico vault, although they could be classified as plagues, had never killed or injured anyone - directly. They had not even existed before the late twentieth century, but in a few decades they had done billions of dollars' worth of damage, and often wrecked lives as effectively as any bodily illness could have done. They were the diseases which attacked Mankind's newest and most versatile servant, the computer.

Taking names from the medical dictionaries - viruses, prions, tapeworms - they were programs that often mimicked, with uncanny accuracy, the behaviour of their organic relatives. Some were harmless - little more than playful jokes, contrived to surprise or amuse Computer operators by unexpected messages and

images on their visual displays. Others were far more malicious - deliberately designed agents of catastrophe.

In most cases their purpose was entirely mercenary; they were the weapons that sophisticated criminals used to blackmail the banks and commercial organizations that now depended utterly upon the efficient operation of their computer systems. On being warned that their data banks would be erased automatically at a certain time, unless they transferred a few megadollars to some anonymous offshore number, most victims decided not to risk possibly irreparable disaster. They paid up quietly, often - to avoid public or even private embarrassment - without notifying the police.

This understandable desire for privacy made it easy for the network highwaymen to conduct their electronic holdups: even when they were caught, they were treated gently by legal systems which did not know how to handle such novel crimes - and, after all, they had not really hurt anyone, had they? Indeed, after they had served their brief sentences, many of the perpetrators were quietly hired by their victims, on the old principle that poachers make the best game-keepers.

These computer criminals were driven purely by greed, and certainly did not wish to destroy the organizations they preyed upon: no sensible parasite kills its host. But there were other, and much more dangerous, enemies of society at work...

Usually, they were maladjusted individuals - typically adolescent males - working entirely alone, and of course in complete secrecy. Their aim was to create programs which would simply create havoc and confusion, when they had been spread over the planet by the world-wide cable and radio networks, or on physical carriers such as diskettes and CD ROMS. Then they would enjoy the resulting chaos, basking in the sense of power it gave their pitiful psyches.

Sometimes, these perverted geniuses were discovered and adopted by national intelligence agencies for their own secretive purposes - usually, to break into the data banks of their rivals. This was a fairly harmless line of employment, as the organizations concerned did at least have some sense of civic responsibility.

Not so the apocalyptic sects, who were delighted to discover this new armoury, holding weapons far more effective, and more easily disseminated, than gas or germs. And much more difficult to counter, since they could be broadcast instantaneously to millions of offices and homes.

The collapse of the New York-Havana Bank in 2005, the launching of Indian nuclear missiles in 2007 (luckily with their warheads unactivated), the shutdown of Pan-European Air Traffic Control in 2008, the paralysis of the North American telephone network in that same year - all these were cult-inspired rehearsals for Doomsday. Thanks to brilliant feats of counterintelligence by normally uncooperative, and even warring, national agencies, this menace was slowly brought under control.

At least, so it was generally believed: there had been no serious attacks at the very foundations of society for several hundred years. One of the chief weapons of victory had been the Braincap - though there were some who believed that this achievement had been bought at too great a cost.

Though arguments over the freedom of the Individual versus the duties of the State were old when Plato and Aristotle attempted to codify them, and would probably continue until the end of time, some consensus had been reached in the Third Millennium. It was generally agreed that Communism was the most perfect form of government; unfortunately it had been demonstrated - at the cost of some hundreds of millions of lives - that it was only applicable to social insects, Robots Class II, and similar restricted categories. For imperfect human beings, the least-worst answer was Demosocracy, frequently defined as 'individual greed, moderated by an efficient but not too zealous government'.

Soon after the Braincap came into general use, some highly intelligent - and maximally zealous - bureaucrats realized that it had a unique potential as an early-warning system. During the setting-up process, when the new wearer was being mentally 'calibrated' it was possible to detect many forms of psychosis before they had a chance of becoming dangerous. Often this suggested the best therapy, but when no cure appeared possible the subject could be electronically tagged - or, in extreme cases, segregated from society. Of course, this mental monitoring could test only those who were fitted with a Braincap - but by the end of the Third Millennium this was as essential for everyday life as the personal telephone had been at its beginning. In fact, anyone who did not join the vast majority was automatically suspect, and checked as a potential deviant.

Needless to say, when 'mind-probing', as its critics called it, started coming into general use, there were cries of outrage from civil-rights organizations; one of their most effective slogans was 'Braincap or Braincop?' Slowly - even reluctantly - it was accepted that this form of monitoring was a necessary precaution against far worse evils; and it was no coincidence that with the general improvement in mental health, religious fanaticism also started its rapid decline-

When the long-drawn-out war against the cybernet criminals ended, the victors found themselves owning an embarrassing collection of spoils, all of them utterly incomprehensible to any past conqueror. There were, of course, hundreds of computer viruses, most of them very difficult to detect and kill. And there were some entities - for want of a better name - that were much more terrifying. They were brilliantly invented diseases for which there was no cure - in some cases not even the possibility of a cure

Many of them had been linked to great mathematicians who would have been horrified by this corruption of their discoveries. As it is a human characteristic to belittle a real danger by giving it an absurd name, the designations were often facetious: the Godel Gremlin, the Mandelbrot Maze, the Combinatorial Catastrophe, the Transfinite Trap, the Conway Conundrum, the Turing Torpedo, the Lorentz Labyrinth, the Boolean Bomb, the Shannon Snare, the Cantor Cataclysm...

If any generalization was possible, all these mathematical horrors operated on the same principle. They did not depend for their effectiveness on anything as naïve as memory-erasure or code corruption - on the contrary. Their approach was more subtle; they persuaded their host machine to initiate a program which could not be completed before the end of the universe, or which - the Mandelbrot Maze was the deadliest example - involved a literally infinite series of steps.

A trivial example would be the calculation of Pi, or any other irrational number. However, even the most stupid electro-optic computer would not fall into such a simple trap: the day had long since passed when mechanical morons would wear out their gears, grinding them to powder as they tried to divide by zero...

The challenge to the demon programmers was to convince their targets that the task set them had a definite conclusion that could be reached in a finite time. In the battle of wits between man (seldom woman, despite such role-models as Lady Ada Lovelace, Admiral Grace Hopper and Dr Susan Calvin) and machine, the machine almost invariably lost.

It would have been possible - though in some cases difficult and even risky - to destroy the captured obscenities by ERASE/OVERWRITE commands, but they represented an enormous investment in time and ingenuity which, however misguided, seemed a pity to waste. And, more important, perhaps they should be kept for study, in some secure location, as a safeguard against the time when some evil genius might reinvent and deploy them.

The solution was obvious. The digital demons should be sealed with their chemical and biological counterparts, it was hoped for ever, in the Pico Vault.

37
Operation Damocles

Poole never had much contact with the team who assembled the weapon everyone hoped would never have to be used. The operation - ominously, but aptly, named Damocles - was so highly specialized that he could contribute nothing directly, and he saw enough of the task force to realize that some of them might almost belong to an alien species. Indeed, one key member was apparently in a lunatic asylum - Poole had been surprised to find that such places still existed - and Chairperson Oconnor sometimes suggested that at least two others should join him.

'Have you ever heard of the Enigma Project?' she remarked to Poole, after a particularly frustrating session. When he shook his head, she continued: 'I'm surprised - it was only a few decades before you were born: I came across it while when I was researching material for Damocles. Very similar problem - in one of your wars, a group of brilliant mathematicians was gathered together, in great secrecy, to break an enemy code... incidentally, they built one of the very first real computers, to make the job possible.'

'And there's a lovely story - I hope it's true - that reminds me of our own little team. One day the Prime Minister came on a visit of inspection, and afterwards he said to Enigma's Director: "When I told you to leave no stone unturned to get the men you needed, I didn't expect you to take me so literally".'

Presumably all the right stones had been turned for Project Damocles. However, as no one knew whether they were working against a deadline of days, weeks or years, at first it was hard to generate any sense of urgency. The need for secrecy also created problems; since there was no point in spreading alarm throughout the Solar System, not more than fifty people knew of the project. But they were the people who mattered - who could marshal all the forces necessary, and who alone could authorize the opening of the Pico Vault, for the first time in five hundred years.

When Halman reported that the Monolith was receiving messages with increasing frequency, there seemed little doubt that something was going to happen. Poole was not the only one who found it hard to sleep in those days, even with the help of the Braincap's anti-insomnia programs. Before he finally did get to sleep, he often wondered if he would wake up again. But at last all the components of the weapon were assembled - a weapon invisible, untouchable and unimaginable to almost all the warriors who had ever lived.

Nothing could have looked more harmless and innocent than the perfectly standard terabyte memory tablet, used with millions of Braincaps every day. But the fact that it was encased in a massive block of crystalline material, criss-crossed with metal bands, indicated that it was something quite out of the ordinary. Poole received it with reluctance; he wondered if the courier who had been given the awesome task of carrying the Hiroshima atom bomb's core to the Pacific airbase from which it was launched had felt the same way. And yet, if all their fears were justified, his responsibility might be even greater.

And he could not be certain that even the first part of his mission would be successful. Because no circuit could be absolutely secure, Halman had not yet been informed about Project Damocles; Poole would do that when he returned to Ganymede.

Then he could only hope that Halman would be willing to play the role of Trojan Horse - and, perhaps, be destroyed in the process.

38
Pre-emptive Strike

It was strange to be back in the Hotel Grannymede after all these years - strangest of all, because it seemed completely unchanged, despite everything that had happened. Poole was still greeted by the familiar image of Bowman as he walked into the suite named after him: and, as he expected, Bowman/Halman was waiting, looking slightly less substantial than the ancient hologram.

Before they could even exchange greetings, there was an interruption that Poole would have welcomed - at any other time than this. The room vidphone gave its urgent trio of rising notes - also unchanged since his last visit -and an old friend appeared on the screen.

'Frank!' cried Theodore Khan, 'why didn't you tell me you were coming! When can we meet? Why no video - someone with you? And who were all those official-looking types who landed at the same time -'

'Please Ted! Yes, I'm sorry - but believe me, I've got very good reasons - I'll explain later. And I do have someone with me - call you back just as soon as I can. Good-bye!'

As he belatedly gave the 'Do Not Disturb' order, Poole said apologetically: 'Sorry about that - you know who it was, of course.'

'Yes - Dr Khan. He often tried to get in touch with me.'

'But you never answered. May I ask why?' Though there were far more important matters to worry about, Poole could not resist putting the question.

'Ours was the only channel I wished to keep open. Also, I was often away. Sometimes for years.'

That was surprising - yet it should not have been. Poole knew well enough that Halman had been reported in many places, in many times. Yet - 'away for years'? He might have visited quite a few star systems - perhaps that was how he knew about Nova Scorpio, only forty light-years distant. But he could never have gone all the way to the Node; there and back would have been a nine-hundred-year journey.

'How lucky that you were here when we needed you!' It was very unusual for Halman to hesitate before replying. There was much longer than the unavoidable three-second time-lag before he said slowly 'Are you sure that it was luck?'

'What do you mean?'

'I do not wish to talk about it, but twice I have - glimpsed - powers - entities - far superior to the Monoliths, and perhaps even their makers. We may both have less freedom than we imagine.'

That was indeed a chilling thought; Poole needed a deliberate effort of will to put it aside and concentrate on the immediate problem.

'Let us hope we have enough free-will to do what is necessary. Perhaps this is a foolish question. Does the Monolith know that we are meeting? Could it be - suspicious?'

'It is not capable of such an emotion. It has numerous fault-protection devices, some of which I understand. But that is all.'

'Could it be overhearing us now?'

'I do not believe so.'

I wish that I could be sure it was such a naïve and simple-minded super-genius, thought Poole as he unlocked his briefcase and took out the sealed box containing the tablet. In this low gravity its weight was almost negligible; it was impossible to believe that it might hold the destiny of Mankind.

'There was no way we could be certain of getting a secure circuit to you, so we couldn't go into details. This tablet contains programs which we hope will prevent the Monolith from carrying out any orders which threaten Mankind. There are twenty of the most devastating viruses ever designed on this, most of which have no known antidote; in some cases, it is believed that none is possible. There are five copies of each. We would like you to release them when - and if - you think it is necessary. Dave - Hal - no one has ever been given such a responsibility. But we have no other choice.'

Once again, the reply seemed to take longer than the three-second round trip from Europa.

'If we do this, all the Monolith's functions may cease. We are uncertain what will happen to us then.'

'We have considered that, of course. But by this lime, you must surely have many facilities at your command -some of them probably beyond our understanding. I am also sending you a petabyte memory tablet. Ten to the fifteenth bytes is more than sufficient to hold all the memories and experiences of many lifetimes. This will give you one escape route: I suspect you have others.'

'Correct. We will decide which to use at the appropriate time.'

Poole relaxed - as far as was possible in this extraordinary situation. Halman was willing to co-operate: he still had sufficient links with his origins.

'Now, we have to get this tablet to you - physically. Its contents are too dangerous to risk sending over any radio or optical channel. I know you possess long-range control of matter: did you not once detonate an orbiting bomb? Could you transport it to Europa? Alternatively, we could send it in an auto-courier, to any point you specify.'

'That would be best: I will collect it in Tsienville. Here are the co-ordinates...

Poole was still slumped in his chair when the Bowman Suite monitor admitted the head of the delegation that had accompanied him from Earth. Whether Colonel Jones was a genuine Colonel - or even if his name was Jones - were minor mysteries which Poole was not really interested in solving; it was sufficient that he was a superb organizer and had handled the mechanics of Operation Damocles with quiet efficiency.

'Well, Frank - it's on its way. Will be landing in one hour, ten minutes. I assume that Halman can take it from there, but I don't understand how he can actually handle - is that the right word? - these tablets.'

'I wondered about that, until someone on the Europa Committee explained it. There's a well-known - though not to me! - theorem stating that any computer can emulate any other computer. So I'm sure that Halman knows exactly what he's doing. He would never have agreed otherwise.'

'I hope you're right,' replied the Colonel. 'If not - well, I don't know what alternative we have.'

There was a gloomy pause, until Poole did his best to relieve the tension.

'By the way, have you heard the local rumour about our visit?'

'Which particular one?'

'That we're a special commission sent here to investigate crime and corruption in this raw frontier township. The Mayor and the Sheriff are supposed to be running scared.'

'How I envy them,' said 'Colonel Jones'. 'Sometimes it's quite a relief to have something trivial to worry about.'

39
Deicide

Like all the inhabitants of Anubis City (population now 56,521), Dr Theodore Khan woke soon after local midnight to the sound of the General Alarm. His first reaction was 'Not another Icequake, for Deus's sake!'

He rushed to the window, shouting 'Open' so loudly that the room did not understand, and he had to repeat the order in a normal voice. The light of Lucifer should have come streaming in, painting the patterns on the floor that so fascinated visitors from Earth, because they never moved even a fraction of a millimetre, no matter how long they waited...

That unvarying beam of light was no longer there. As Khan stared in utter disbelief through the huge, transparent bubble of the Anubis Dome, he saw a sky that Ganymede had not known for a thousand years. It was once more ablaze with stars; Lucifer had gone.

And then, as he explored the forgotten constellations, Kahn noticed something even more terrifying. Where Lucifer should have been was a tiny disc of absolute blackness, eclipsing the unfamiliar stars.

There was only one possible explanation, Khan told himself numbly. Lucifer has been swallowed by a Black Hole. And it may be our turn next.

On the balcony of the Grannymede Hotel, Poole was watching the same spectacle, but with more complex emotions. Even before the general alarm, his comsec had woken him with a message from Halman.

'It is beginning. We have infected the Monolith. But one - perhaps several - of the viruses have entered our own circuits. We do not know if we will be able to use the memory tablet you have given us. If we succeed, we will meet you in Tsienville.'

Then came the surprising and strangely moving words whose exact emotional content would be debated for generations:

'If we are unable to download, remember us.' From the room behind him, Poole heard the voice of the Mayor, doing his best to reassure the now sleepless citizens of Anubis. Though he opened with that most terrifying of official statements - 'No cause for alarm' - the Mayor did indeed have words of comfort.

'We don't know what's happening but Lucifer's still shining normally! I repeat - Lucifer is still shining! We've just received news from the interorbit shuttle Alcyone, which left for Callisto half an hour ago. Here's their view -, Poole left the balcony and rushed into his room just in time to see Lucifer blaze reassuringly on the vidscreen.

'What's happened,' the Mayor continued breathlessly, 'is that something has caused a temporary eclipse - we'll zoom in to look at it... Callisto Observatory, come in please...'

How does he know it's 'temporary'? thought Poole, as he waited for the next image to come up on the screen.

Lucifer vanished, to be replaced by a field of stars. At the same time, the Mayor faded out and another voice took over:

'- two-metre telescope, but almost any instrument will do. It's a disc of perfectly black material, just over ten thousand kilometres across, so thin it shows no visible thickness. And it's placed exactly - obviously deliberately -to block Ganymede from receiving any light.

'We'll zoom in to see if it shows any details, though I rather doubt it...'

From the viewpoint of Callisto, the occulting disc was foreshortened into an oval, twice as long as it was wide. It expanded until it completely filled the screen; thereafter, it was impossible to tell whether the image was being zoomed, as it showed no structure whatsoever.

'As I thought - there's nothing to see. Let's pan over to the edge of the thing...'

Again there was no sense of motion, until a field of stars suddenly appeared, sharply defined by the curving edge of the world-sized disc. It was exactly as if they were looking past the horizon of an airless, perfectly smooth planet.

No, it was not perfectly smooth...

'That's interesting,' commented the astronomer, who until now had sounded remarkably matter-of-fact, as if this sort of thing was an everyday occurrence. 'The edge looks jagged - but in a very regular fashion - like a saw-blade...'

A circular saw Poole muttered under his breath. Is it going to carve us up? Don't be ridiculous...

'This is as close as we can get before diffraction spoils the image - we'll process it later and get much better detail:'

The magnification was now so great that all trace of the disc's circularity had vanished. Across the vidscreen was a black band, serrated along its edge with triangles so identical that Poole found it hard to avoid the ominous analogy of a saw-blade. Yet something else was nagging at the back of his mind...

Like everyone else on Ganymede, he watched the infinitely more distant stars drifting in and out of those geometrically perfect valleys. Very probably, many others jumped to the same conclusion even before he did.

If you attempt to make a disc out of rectangular blocks -whether their proportions are 1:4:9 or any other - it cannot possibly have a smooth edge. Of course, you can make it as near a perfect circle as you like, by using smaller and smaller blocks. Yet why go to that trouble, if you merely wanted to build a screen large enough to eclipse a sun?

The Mayor was right; the eclipse was indeed temporary. But its ending was the precise opposite of a solar one.

First light broke through at the exact centre, not in the usual necklace of Bailey's Beads along the very edge. Jagged lines radiated from a dazzling pinhole - and now, under the highest magnification, the structure of the disc

was being revealed. It was composed of millions of identical rectangles, perhaps the same size as the Great Wall of Europa. And now they were splitting apart: it was as if a gigantic jigsaw puzzle was being dismantled.

Its perpetual, but now briefly interrupted, daylight was slowly returning to Ganymede, as the disc fragmented and the rays of Lucifer poured through the widening gaps. Now the components themselves were evaporating, almost as if they needed the reinforcement of each other's contact to maintain reality.

Although it seemed like hours to the anxious watchers in Anubis City, the whole event lasted for less than fifteen minutes. Not until it was all over did anyone pay attention to Europa itself.

The Great Wall was gone: and it was almost an hour before the news came from Earth, Mars and Moon that the Sun itself had appeared to flicker for a few seconds, before resuming business as usual.

It had been a highly selective set of eclipses, obviously targeted at humankind. Nowhere else in the Solar System would anything have been noticed.

In the general excitement, it was a little longer before the world realized that TMA ZERO and TMA ONE had both vanished, leaving only their four-million-year-old imprints on Tycho and Africa.

It was the first time the Europs could ever have met humans, but they seemed neither alarmed nor surprised by the huge creatures moving among them at such lightning speed. Of course, it was not too easy to interpret the emotional state of something that looked like a small, leafless bush, with no obvious sense organs or means of communication. But if they were frightened by the arrival of Alcyone, and the emergence of its passengers, they would surely have remained hiding in their igloos.

As Frank Poole, slightly encumbered by his protective suit and the gift of shining copper wire he was carrying, walked into the untidy suburbs of Tsienville, he wondered what the Europs thought of recent events. For them, there had been no eclipse of Lucifer, but the disappearance of the Great Wall must surely have been a shock. It had stood there for a thousand years, as a shield and doubtless much more; then, abruptly, it was gone, as if it had never been...

The petabyte tablet was waiting for him, with a group of Europs standing around it, demonstrating the first sign of curiosity that Poole had ever observed in them. He wondered if Halman had somehow told them to watch over this gift from space, until he came to collect it.

And to take it back, since it now contained not only a sleeping friend but terrors which some future age might exorcise, to the only place where it could be safely stored.

It would be hard, Poole thought, to imagine a more peaceful scene - especially after the trauma of the last weeks. The slanting rays of a nearly full Earth revealed all the subtle details of the waterless Sea of Rains - not obliterating them, as the incandescent fury of the Sun would do.

The small convoy of mooncars was arranged in a semicircle a hundred metres from the inconspicuous opening at the base of Pico that was the entrance to the Vault. From this viewpoint, Poole could see that the mountain did not live up to the name that the early astronomers, misled by its pointed shadow, had given to it. It was more like a rounded hill than a sharp peak, and he could well believe that one of the local pastimes was bicycle-riding to the summit. Until now, none of those sportsmen and women could have guessed at the secret hidden beneath their wheels: he hoped that the sinister knowledge would not discourage their healthy exercise.

An hour ago, with a sense of mingled sadness and triumph, he had handed over the tablet he had brought -never letting it out of his sight - from Ganymede directly to the Moon.

'Good-bye, old friends,' he had murmured. 'You've done well. Perhaps some future generation will reawaken you. But on the whole - I rather hope not.'

He could imagine, all too clearly, one desperate reason why Halman's knowledge might be needed again. By now, surely, some message was on its way to that unknown control centre, bearing the news that its servant on Europa no longer existed. With reasonable luck, it would take 950 years, give or take a few, before any response could be expected.

Poole had often cursed Einstein in the past; now he blessed him. Even the powers behind the Monoliths, it now appeared certain, could not spread their influence faster than the speed of light. So the human race should have almost a millennium to prepare for the next encounter - if there was to be one. Perhaps by that time, it would be better prepared.

Something was emerging from the tunnel - the track-mounted, semi-humanoid robot that had carried the tablet into the Vault. It was almost comic to see a machine enclosed in the kind of isolation suit used as protection against deadly germs and here on the airless Moon! But no one was taking any chances, however unlikely they might seem. After all, the robot had moved among those carefully sequestered nightmares, and although according to its video cameras everything appeared in order, there was always a chance that some vial had leaked, or some canister's seal had broken. The Moon was a very stable environment, but during the centuries it had known many quakes and meteor impacts.

The robot came to a halt fifty metres outside the tunnel. Slowly, the massive plug that sealed the Vault swung back into place, and began to rotate in its threads, like a giant bolt being screwed into the mountain.

'All not wearing dark glasses, please close your eyes or look away from the robot!' said an urgent voice over the mooncar radio. Poole twisted round in his seat, just in time to see an explosion of light on the roof of the vehicle. When he turned back to look at Pico, all that was left of the robot was a heap of glowing slag; even to someone who had spent much of his life surrounded by vacuum, it seemed altogether wrong that tendrils of smoke were not slowly spiralling up from it.

'Sterilization completed,' said the voice of the Mission Controller. 'Thank you, everybody. Now returning to Plato City.'

How ironic - that the human race had been saved by the skilful deployment of its own insanities! What moral, Poole wondered, could one possibly draw from that?

He looked back at the beautiful blue Earth, huddling beneath its tattered blanket of clouds for protection against the cold of space. Up there, a few weeks from now, he hoped to cradle his first grandson in his arms.

Whatever godlike powers and principalities lurked beyond the stars, Poole reminded himself, for ordinary humans only two things were important - Love and Death.

His body had not yet aged a hundred years: he still had plenty of time for both.

EPILOGUE

'Their little universe is very young, and its god is still a child. But it is too soon to judge them; when We return in the Last Days, We will consider what should be saved.'

SOURCES AND ACKNOWLEDGEMENTS

SOURCES

Chapter 1: The Kuiper Belt

For a description of Captain Chandler's hunting ground, discovered as recently as 1992, see 'The Kuiper Belt' by Jane X. Luu and David C. Jewitt (Scientific American, May 1996)

Chapter 3: Rehabilitation

I believed that I had invented the palm-to-palm transfer of information, so it was mortifying to discover that Nicholas ("Being Digital") Negroponte (Hodder and Stoughton, 1995) and his MIT Media Lab have been working on the idea for years...

Chapter 4: Star City

The concept of a 'ring around the world' in the geostationary orbit (CEO), linked to the Earth by towers at the Equator, may seem utterly fantastic but in fact has a firm scientific basis. It is an obvious extension of the 'space elevator' invented by the St Petersburg engineer Yuri Artsutanov, whom I had the pleasure of meeting in 1982, when his city had a different name.

Yuri pointed out that it was theoretically possible to lay a cable between the Earth and a satellite hovering over the same spot on the Equator which it does when placed in the CEO, home of most of today's communications satellites. From this beginning, a space elevator (or in Yuri's picturesque phrase, 'cosmic funicular') could be established, and payloads could be carried up to the CEO purely by electrical energy. Rocket propulsion would be needed only for the remainder of the journey.

In addition to avoiding the danger, noise and environmental hazards of rocketry, the space elevator would make possible quite astonishing reductions in the cost of all space missions. Electricity is cheap, and it would require only about a hundred dollars' worth to take one person to orbit. And the round trip would cost about ten dollars, as most of the energy would be recovered on the downward journey! (Of course, catering and inflight movies would put up the price of the ticket. Would you believe a thousand dollars to CEO and back?)

The theory is impeccable: but does any material exist with sufficient tensile strength to hang all the way down to the Equator from an altitude of 36,000 kilometres, with enough margin left over to raise useful payloads? When Yuri wrote his paper, only one substance met these rather stringent specifications - crystalline carbon, better known as diamond. Unfortunately, the necessary megaton quantities are not readily available on the open market, though in "2061: Odyssey Three" I gave reasons for thinking that they might exist at the core of Jupiter. In "The Fountains of Paradise" I suggested a more accessible source - orbiting factories where diamonds might be grown under zero-gravity conditions.

The first 'small step' towards the space elevator was attempted in August 1992 on the Shuttle Atlantis, when one experiment involved the release - and retrieval - of a payload on a 21-kilometre-long tether. Unfortunately the playing-out mechanism jammed after only a few hundred metres.

I was very flattered when the Atlantis crew produced The Fountains of Paradise during their orbital press conference, and Mission Specialist Jeffrey Hoffman sent me the autographed copy on their return to Earth.

The second tether experiment, in February 1996, was slightly more successful: the payload was indeed deployed to its full distance, but during retrieval the cable was severed, owing to an electrical discharge caused by faulty insulation. This may have been a lucky accident - perhaps the equivalent of a blown fuse:

I cannot help recalling that some of Ben Franklin's contemporaries were killed when they attempted to repeat his famous - and risky - experiment of flying a kite during a thunderstorm.

Apart from possible dangers, playing-out tethered payloads from the Shuttle appears rather like fly-fishing: is not as easy as it looks. But eventually the final 'giant leap' will be made - all the way down to the Equator.

Meanwhile, the discovery of the third form of carbon, buckminsterfullerene (C60) has made the concept of the space elevator much more plausible. In 1990 a group of chemists at Rice University, Houston, produced a tubular form of C60 - which has far greater tensile strength than diamond. The group's leader, Dr Smalley, even went so far as to claim it was the strongest material that could ever exist - and added that it would make possible the construction of the space elevator.

(Stop Press News: I am delighted to know that Dr Smalley has shared the 1996 Nobel Prize in Chemistry for this work.)

And now for a truly amazing coincidence - one so eerie that it makes me wonder Who Is In Charge.

Buckminster Fuller died in 1983, so never lived to see the discovery of the 'buckyballs' and 'buckytubes' which have given him much greater posthumous fame. During one of the last of his many world trips, I had the pleasure of flying him and his wife Anne around Sri Lanka, and showed them some of the locations featured in The Fountains of Paradise. Shortly afterwards, I made a recording from the novel on a 12" (remember them?) LP record (Caedmon TC 1606) and Bucky was kind enough to write the sleeve notes. They ended with a surprising revelation, which may well have triggered my own thinking about 'Star City':

'In 1951 I designed a free-floating tensegrity ring-bridge to be installed way out from and around the Earth's equator. Within this "halo" bridge, the Earth would continue its spinning while the circular bridge would revolve at its own rate. I foresaw Earthian traffic vertically ascending to the bridge, revolving and descending at preferred Earth loci'

I have no doubt that, if the human race decides to make such an investment (a trivial one, according to some estimates of economic growth), 'Star City' could be constructed. In addition to providing new styles of living, and giving visitors from low-gravity worlds like Mars and the Moon better access to the Home Planet, it would eliminate all rocketry from the Earth's surface and relegate it to deep space, where it belongs (Though I hope there would be occasional anniversary re-enactments at Cape Kennedy, to bring back the excitement of the pioneering days.)

Almost certainly most of the City would be empty scaffolding, and only a very small fraction would be occupied or used for scientific or technological purposes. After all, each of the Towers would be the equivalent of a ten-million-floor skyscraper - and the circumference of the ring around the geostationary orbit would be more than half the distance to the Moon! Many times the entire population of the human race could be housed in such a volume of space, if it was all enclosed. (This would pose some interesting logistics problems, which I am content to leave as 'an exercise for the student'.)

Chapter 5: Education

I was astonished to read in a newspaper on 19 July 1996 that Dr Chris Winter, head of British Telecom's Artificial Life Team, believes that the information and storage device I described in this chapter could be developed within 30 years! (In my 1956 novel The City and the Stars I put it more than a billion years in the future... obviously a serious failure of imagination.) Dr Winter states that it would allow us to 'recreate a person physically,

emotionally and spiritually', and estimates that the memory requirements would be about 10 terabytes (10e13 bytes), two orders of magnitude less than the petabyte (10e15 bytes) I suggest.

And I wish I'd thought of Dr Winter's name for this device, which will certainly start some fierce debates in ecclesiastical circles: the 'Soul Catcher'... For its application to interstellar travel, see following note on Chapter 9.

For an excellent history of the 'Beanstalk' concept (as well as many other even farther-out ideas such as anti-gravity and space-warps) see Robert L. Forward's "Indistinguishable From Magic" (Baen 1995).

Chapter 7: Infinite Energy

If the inconceivable energy of the Zero Point Field (sometimes referred to as 'quantum fluctuations' or 'vacuum energy') can ever be tapped, the impact upon our civilization will be incalculable. All present sources of power - oil, coal, nuclear, hydro, solar - would become obsolete, and so would many of our fears about environmental pollution. They would all be wrapped up in one big worry - heat pollution. All energy eventually degrades to heat, and if everyone had a few million kilowatts to play with, this planet would soon be heading the way of Venus - several hundred degrees in the shade.

However, there is a bright side to the picture: there may be no other way of averting the next Ice Age, which otherwise is inevitable ('Civilization is an interval between Ice Ages' - Will Durant: "The Story of Civilization", Fine Communications, US, 1993)

Even as I write this, many competent engineers, in laboratories all over the world, claim to be tapping this new energy source. Some idea of its magnitude is contained in a famous remark by the physicist Richard Feynman, to the effect that the energy in a coffee-mug's volume (any such volume, anywhere!) is enough to boil all the oceans of the world. This, surely, is a thought to give one pause. By comparison, nuclear energy looks as feeble as a damp match.

And how many supernovae, I wonder, really are industrial accidents?

Chapter 9: Skyland

One of the main problems of getting around in Star City would be caused by the sheer distances involved: if you wanted to visit a friend in the next Tower (and communications will never completely replace contact, despite all advances in Virtual Reality) it could be the equivalent of a trip to the Moon. Even with the fastest elevators this would involve days rather than hours, or else accelerations quite unacceptable to people who had adapted to low-gravity life.

The concept of an 'inertialess drive' - i.e. a propulsion system that acts on every atom of a body so that no strains are produced when it accelerates - was probably invented by the master of the 'Space Opera', E.E. Smith, in the 1930s. It is not as improbable as it sounds - because a gravitational field acts in precisely this manner.

If you fall freely near the Earth (neglecting the effects of air resistance) you will increase speed by just under ten metres per second, every second. Yet you will feel weightless - there will be no sense of acceleration, even though your velocity is increasing by one kilometre a second, every minute and a half!

And this would still be true if you were falling in Jupiter's gravity (just over two-and-a-half times Earth's) or even the enormously more powerful field of a white dwarf or neutron star (millions or billions of times greater). You would feel nothing, even if you had approached the velocity of light from a standing start in a matter of minutes. However, if you were foolish enough to get within a few radii of the attracting object, its field would no longer be uniform over the whole length of your body, and tidal forces would soon tear you to pieces. For further details, see my deplorable but accurately-titled short story 'Neutron Tide' (in "The Wind from the Sun").

An 'inertialess drive', which would act exactly like a controllable gravity field, had never been discussed seriously outside the pages of science fiction until very recently. But in 1994 three American physicists did exactly this, developing some ideas of the great Russian physicist Andrei Sakharov.

'Inertia as a Zero-Point Field Lorentz Force' by B. Haisch, A. Rueda & H. F. Puthoff (Physics Review A, February 1994) may one day be regarded as a landmark paper, and for the purposes of fiction I have made it so. It addresses a problem so fundamental that it is normally taken for granted, with a that's-just-the-way-the-universe-is-made shrug of the shoulders.

The question HR&P asked is: 'What gives an object mass (or inertia) so that it requires an effort to start it moving, and exactly the same effort to restore it to its original state?'

Their provisional answer depends on the astonishing - and outside the physicists' ivory towers - little-known fact that so-called 'empty' space is actually a cauldron of seething energies - the Zero-Point Field (see note above). HR&P suggest that both inertia and gravitation are electromagnetic phenomena, resulting from interaction with this field.

There have been countless attempts, going all the way back to Faraday, to link gravity and magnetism, and although many experimenters have claimed success, none of their results has ever been verified. However, if HR&P's theory can be proved, it opens up the prospect - however remote - of anti-gravity, 'space drives' and the even more fantastic possibility of controlling inertia. This could lead to some interesting situations: if you gave someone the gentlest touch, they would promptly disappear at thousands of kilometres an hour, until they bounced off the other side of the room a fraction of a millisecond later. The good news is that traffic accidents would be virtually impossible; automobiles - and passengers - could collide harmlessly at any speed.

(And you think that today's life-styles are already too hectic?)

The 'weightlessness' which we now take for granted in space missions - and which millions of tourists will be enjoying in the next century - would have seemed like magic to our grandparents. But the abolition - or merely the reduction - of inertia is quite another matter, and may be completely impossible.* But it's a nice thought, for it could provide the equivalent of 'teleportation': you could travel anywhere (at least on Earth) almost instantaneously. Frankly, I don't know how 'Star City' could manage without it...

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* As every Trekker knows, the Starship Enterprise uses 'inertial dampers' to solve this particular problem. When asked how these work, the series' technical advisor gave the only possible answer: 'very well, thank you.' (See "The Physics of Star Trek" by Lawrence Krauss: HarperCollins, 1996.)

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One of the assumptions I have made in this novel is that Einstein is correct, and that no signal - or object - can exceed the speed of light. A number of highly mathematical papers have recently appeared suggesting that, as countless science-fiction writers have taken for granted, galactic hitch-hikers may not have to suffer this annoying disability.

On the whole, I hope they are right - but there seems one fundamental objection. If FTL is possible, where are all those hitchhikers - or at least the well-heeled tourists?

One answer is that no sensible ETs will ever build interstellar vehicles, for precisely the same reason that we have never developed coal-fuelled airships: there are much better ways of doing the job.

The surprisingly small number of 'bits' required to define a human being, or to store all the information one could possibly acquire in a lifetime, is discussed in 'Machine Intelligence, the Cost of Interstellar Travel and Fermi's Paradox' by Louis K. Scheffer (Quarterly Journal of the Royal Astronomical Society, Vol. 35, No. 2, June 1994: pp. 157-75). This paper (surely the most mind-stretching that the staid QJRAS has published in its entire career!) estimates that the total mental state of a 100-year-old human with a perfect memory could be represented by 10 to the 15th bits (one petabit). Even today's optical fibres could transmit this amount of information in a matter of minutes.

My suggestion that a Star Trek transporter would still be unavailable in 3001 may therefore appear ludicrously shortsighted a mere century from now* and the present lack of interstellar tourists is simply due to the fact that no receiving equipment has yet been set up on Earth. Perhaps it's already on its way by slow-boat...

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* However, for a diametrically opposing view, see the above-mentioned "Physics of Star Trek".

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Chapter 15: Falcon

It gives me particular pleasure to pay this tribute to the crew of Apollo 15. On their return from the Moon they sent me the beautiful relief map of

Falcon's landing site, which now has pride of place in my office. It shows the routes taken by the Lunar Rover during its three excursions, one of which skirted Earthlight Crater. The map bears the inscription: 'To Arthur Clarke from the crew of Apollo 15 with many thanks for your visions of space. Dave Scott, Al Worden, Jim Irwin.' In return, I have now dedicated "Earthlight" (which, written in 1953, was set in the territory the Rover was to drive over in 1971): 'To Dave Scott and Jim Irwin, the first men to enter this land, and to Al Worden, who watched over them from orbit.'

After covering the Apollo 15 landing in the CBS studio with Walter Cronkite and Wally Schirra, I flew to Mission Control to watch the re-entry and splashdown. I was sitting beside Al Worden's little daughter when she was the first to notice that one of the capsule's three parachutes had failed to deploy. It was a tense moment, but luckily the remaining two were quite adequate for the job.

Chapter 16: Asteroid 7794

See Chapter 18 of "2001: A Space Odyssey" for the description of the probe's impact. Precisely such an experiment is now being planned for the forthcoming Clementine 2 mission.

I am a little embarrassed to see that in my first Space Odyssey the discovery of Asteroid 7794 was attributed to the Lunar Observatory - in 1997! Well, I'll move it to 2017 - in time for my 100th birthday.

Just a few hours after writing the above, I was delighted to learn that Asteroid 4923 (1981 EO27), discovered by S. J. Bus at Siding Spring, Australia, on 2 March 1981, has been named Clarke, partly in recognition of Project Spaceguard (see "Rendezvous with Rama" and "The Hammer of God"). I was informed, with profound apologies, that owing to an unfortunate oversight Number 2001 was no longer available, having been allocated to somebody named A. Einstein. Excuses, excuses.

But I was very pleased to learn that Asteroid 5020, discovered on the same day as 4923, has been named Asimov - though saddened by the fact that my old friend could never know.

Chapter 17: Ganymede

As explained in the Valediction, and in the Author's Notes to "2010 Odyssey Two" and "2061 Odyssey Three", I had hoped that the ambitious Galileo Mission to Jupiter and its moons would by now have given us much more detailed knowledge - as well as stunning close-ups - of these strange worlds.

Well, after many delays, Galileo reached its first objective - Jupiter itself - and is performing admirably. But, alas, there is a problem - for some reason, the main antenna never unfolded. This means that images have to be sent back via a low-gain antenna, at an agonizingly slow rate. Although miracles of onboard computer reprogramming have been done to compensate for this, it will still require hours to receive information that should have been sent in minutes.

So we must be patient - and I was in the tantalizing position of exploring Ganymede in fiction just before Galileo started to do so in reality, on 27 June 1996.

On 11 July 1996, just two days before finishing this book, I downloaded the first images from JPL; luckily nothing - so far! -contradicts my descriptions. But if the current vistas of cratered ice-fields suddenly give way to palm trees and tropical beaches - or, worse still, YANKEE GO HOME signs, I'll be in real trouble .

I am particularly looking forward to close-ups of 'Ganymede City' (Chapter 17). This striking formation is exactly as I described it - though I hesitated to do so for fear that my 'discovery' might be front-paged by the National Prevaricator. To my eyes it appears considerably more artificial than the notorious 'Mars Face' and its surroundings. And if its streets and avenues are ten kilometres wide - so what? Perhaps the Medes were BIG...

The city will be found on the NASA Voyager images 20637.02 and 20637.29, or more conveniently in Figure 23.8 of John H. Rogers's monumental "The Giant Planet Jupiter" (Cambridge University Press, 1995).

Chapter 19: The Madness of Mankind

For visual evidence supporting Khan's startling assertion that most of mankind has been at least partially insane, see Episode 22, 'Meeting Mary', in my television series Arthur C. Clarke's Mysterious Universe. And bear in mind that Christians represent only a very small subset of our species: far greater numbers of devotees than have ever worshipped the Virgin Mary have given equal reverence to such totally incompatible divinities as Rama, Kali, Siva, Thor, Wotan, Jupiter, Osiris, etc. etc....

The most striking - and pitiful - example of a brilliant man whose beliefs turned him into a raving lunatic is that of Conan Doyle. Despite endless exposures of his favourite psychics as frauds, his faith in them remained unshaken. And the creator of Sherlock Holmes even tried to convince the great magician Harry Houdini that he 'dematerialized' himself to perform his feats of escapology - often based on tricks which, as Dr Watson was fond of saying, were 'absurdly simple'. (See the essay 'The Irrelevance of Conan Doyle' in Martin Gardner's "The Night is Large", St Martin's Press, US, 1996.)

For details of the Inquisition, whose pious atrocities make Pol Pot look positively benign, see Carl Sagan's devastating attack on New Age Nitwittery, "The Demon-Haunted World: Science as a Candle in the Dark" (Headline, 1995). I wish it - and Martin's book - could be made required reading in every high school and college.

At least the US Department of Immigration has taken action against one religion-inspired barbarity. Time Magazine ('Milestones', 24 June 1996) reports that asylum must now be granted to girls threatened with genital mutilation in their countries of origin.

I had already written this chapter when I came across Anthony Storr's "Feet of Clay: A Study of Gurus" (HarperCollins, 1996), which is a virtual textbook on this depressing subject. It is hard to believe that one holy fraud, by the time the US Marshals belatedly arrested him, had accumulated ninety-three Rolls-

Royces! Even worse - eighty-three per cent of his thousands of American dupes had been to college, and thus qualify for my favourite definition of an intellectual: 'Someone who has been educated beyond his/her intelligence.'

Chapter 26: Tsienville

In the 1982 preface to "2010: Odyssey Two", I explained why I named the Chinese spaceship which landed on Europa after Dr Tsien Hsue-shen, one of the founders of the United States and Chinese rocket programmers. As Iris Chang states in her biography "Thread of the Silkworm" (Basic Books, 1995) 'his life is one of the supreme ironies of the Cold War'.

Born in 1911, Tsien won a scholarship which brought him from China to the United States in 1935, where he became student and later colleague of the brilliant Hungarian aerodynamicist Theodore von Karman. Later, as first Goddard Professor at the California Institute of Technology, he helped establish the Guggenheim Aeronautical Laboratory - the direct ancestor of Pasadena's famed Jet Propulsion Laboratory.

With top secret clearance, he contributed greatly to American rocket research in the 1950s, but during the hysteria of the McCarthy era was arrested on trumped-up security charges when he attempted to pay a visit to his native China. After many hearings and a prolonged period of arrest, he was finally deported to his homeland - with all his unrivalled knowledge and expertise. As many of his distinguished colleagues affirmed, it was one of the most stupid (as well as most disgraceful) things the United States ever did.

After his expulsion, according to Thuang Fenggan, Deputy Director, China National Space Administration, Tsien 'started the rocket business from nothing... Without him, China would have suffered a twenty-year lag in technology.' And a corresponding delay, perhaps, in the deployment of the deadly 'Silkworm' anti-ship missile and the 'Long March' satellite launcher.

Shortly after I had completed this novel, the International Academy of Astronautics honoured me with its highest distinction, the von Karman Award - to be given in Beijing! This was an offer I couldn't refuse, especially when I learned that Dr Tsien is now a resident of that city. Unfortunately, when I arrived there I discovered that he was in hospital for observation, and his doctors would not permit visitors.

I am therefore extremely grateful to his personal assistant, Major-General Wang Shouyun, for carrying suitably inscribed copies of 2010 and 2061 to Dr Tsien. In return the General presented me with the massive volume he has edited, "Collected Works of H. S. Tsien: 1938-1956" (1991, Science Press, 16, Donghuangcheggen North Street, Beijing 100707). It is a fascinating collection, beginning with numerous collaborations with von Karman on problems in aerodynamics, and ending with solo papers on rockets and satellites. The very last entry, 'Thermonuclear Power Plants' (Jet Propulsion, July 1956) was written while Dr Tsien was still a virtual prisoner of the FBI, and deals with a subject that is even more topical today - though very little progress has been made towards 'a power station utilizing the deuterium fusion reaction'.

Just before I left Beijing on 13 October 1996 I was happy to learn that, despite his current age (85) and disability, Dr Tsien is still pursuing his

scientific studies. I sincerely hope that he enjoyed "2010" and "2061", and look forward to sending him this "Final Odyssey" as an additional tribute.

Chapter 36: Chamber of Horrors

As the result of a series of Senate Hearings on Computer Security in June 1996, on 15 July 1996 President Clinton signed Executive Order 13010 to deal with 'computer-based attacks on the information or communications components that control critical infrastructures ("cyber threats").' This will set up a task force to counter cyberterrorism, and will have representatives from the CIA, NSA, defense agencies, etc.

Pico, here we come...

Since writing the above paragraph, I have been intrigued to learn that the finale of the movie Independence Day, which I have not yet seen, also involves the use of computer viruses as Trojan horses! I am also informed that its opening is identical to that of Childhood's End (1953), and that it contains every known science-fiction cliche´ since Me´lie`s's Trip to the Moon (1903).

I cannot decide whether to congratulate the script-writers on their one stroke of originality - or to accuse them of the transtemporal crime of pre-cognitive plagiarism. In any event, I fear there's nothing I can do to stop John Q. Popcorn thinking that I have ripped off the ending of ID4.

The following material has been taken - usually with major editing - from the earlier books in the series:

From "2001 A Space Odyssey": Chapter 18 Through the Asteroids and Chapter 37 Experiment.

From "2010: Odyssey Two": Chapter 11 Ice and Vacuum; Chapter 36 Fire in the Deep: Chapter 38 Foamscape.

ACKNOWLEDGEMENTS

My thanks to IBM for presenting me with the beautiful little Thinkpad 755CD on which this book was composed. For many years I have been embarrassed by the - totally unfounded -rumour that the name HAL was derived by one-letter displacement from IBM. In an attempt to exorcise this computer-age myth, I even went to the trouble of getting Dr Chandra, HAL's inventor, to deny it in 2010 Odyssey Two. However, I was recently assured that, far from being annoyed by the association, Big Blue is now quite proud of it. So I will abandon any future attempts to put the record straight - and send my congratulations to all those participating in HAL's 'birthday party' at (of course) the University of Illinois, Urbana, on 12 March 1997.

Rueful gratitude to my Del Rey Books editor, Shelly Shapiro, for ten pages of niggles which, when dealt with, made a vast improvement to the final product. (Yes, I've been an editor myself, and do not suffer from the usual author's conviction that the members of this trade are frustrated butchers.)

Finally, and most important of all: my deepest thanks to my old friend Cyril Gardiner, Chairman of the Galle Face Hotel, for the hospitality of his magnificent (and enormous) personal suite while I was writing this book: he gave me a Tranquillity Base in a time of troubles. I hasten to add that, even though it may not provide such extensive imaginary landscapes, the facilities of the Galle Face are far superior to those offered by the 'Grannymede', and never in my life have I worked in more comfortable surroundings.

Or, for that matter, in more inspirational ones, for a large plaque at the entrance lists more than a hundred of the Heads of State and other distinguished visitors who have been entertained here. They include Yuri Gagarin, the crew of Apollo 12 - the second mission to the Moon's surface - and a fine collection of stage and movie stars: Gregory Peck, Alec Guinness, Noel Coward, Carrie Fisher of "Star Wars" fame... As well as Vivien Leigh and Laurence Olivier - both of whom make brief appearances in "2061 Odyssey Three" (Chapter 37). I am honoured to see my name listed among them.

It seems appropriate that a project begun in one famous hotel - New York's Chelsea, that hotbed of genuine and imitation genius - should be concluded in another, half a world away. But it's strange to hear the monsoon-lashed Indian Ocean roaring just a few yards outside my window, instead of the traffic along far-off and fondly remembered 23rd Street.

IN MEM0RIAM: 18 SEPTEMBER 1996

It was with the deepest regret that I heard - literally while editing this acknowledgements - that Cyril Gardiner died a few hours ago. It is some consolation to know that he had already seen the above tribute and was delighted with it.

VALEDICTION

'Never explain, never apologize' may be excellent advice for politicians, Hollywood moguls and business tycoons, but an author should treat his readers with more consideration. So, though I have no intention of apologizing for anything, perhaps the complicated genesis of the Odyssey Quartet requires a little explaining.

It all began at Christmas 1948 - yes, 1948! - with a 4,000-word short story which I wrote for a contest sponsored by the British Broadcasting Corporation. 'The Sentinel' described the discovery of a small pyramid on the Moon, set there by some alien civilization to await the emergence of mankind as a planet-faring species. Until then, it was implied, we would be too primitive to be of any interest.* The BBC rejected my modest effort, and it was not published until

almost three years later in the one-and-only (Spring 1951) issue of 10 Story Fantasy - a magazine which, as the invaluable "Encyclopaedia of Science Fiction" wryly comments, is 'primarily remembered for its poor arithmetic (there were 13 stories)'.

'The Sentinel' remained in limbo for more than a decade, until Stanley Kubrick contacted me in the spring of 1964 and asked if I had any ideas for the 'proverbial' (i.e. still non-existent) 'good science-fiction movie'. During the course of our many brainstorming sessions, as recounted in "The Lost Worlds of 2001" (Sidgwick and Jackson, 1972) we decided that the patient watcher on the Moon might provide a good starting point for our story. Eventually it did much more than that, as somewhere during production the pyramid evolved into the now famous black monolith.

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* The search for alien artefacts in the Solar System should be a perfectly legitimate branch of science ('exo-archaeology'?). Unfortunately, it has been largely discredited by claims that such evidence has already been found - and has been deliberately suppressed by NASA! It is incredible that anyone would believe such nonsense: far more likely that the space agency would deliberately fake ET artefacts - to solve its budget problems! (Over to you, NASA Administrators...)

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To put the Odyssey series in perspective, it must be remembered that when Stanley and I started planning what we privately called 'How the Solar System was Won' the Space Age was barely seven years old, and no human had travelled more than a hundred kilometres from the home planet. Although President Kennedy had announced that the United States intended to go to the Moon 'in this decade', to most people that must still have seemed like a far-off dream. When filming started just west of London* on a freezing 29 December 1965, we did not even know what the lunar surface looked like at close quarters. There were still fears that the first word uttered by an emerging astronaut would be 'Help!' as he disappeared into a talcum-power-like layer of moondust. On the whole, we guessed fairly well: only the fact that our lunar landscapes are more jagged than the real ones - smoothed by aeons of sand-blasting by meteoric dust - reveals that 2001 was made in the pre-Apollo era.

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* At Shepperton, destroyed by the Martians in one of the most dramatic scenes in wells's masterpiece, The War of the Worlds.

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Today, of course, it seems ludicrous that we could have imagined giant space-stations, orbiting Hilton Hotels, and expeditions to Jupiter as early as

2001. It is now difficult to realize that back in the 1960s there were serious plans for permanent Moon bases and Mars landings - by 1990! Indeed, in the CBS studio, immediately after the Apollo 11 launch, I heard the Vice-President of the United States proclaim exuberantly: 'Now we must go to Mars!'

As it turned out, he was lucky not to go to prison. That scandal, plus Vietnam and Watergate, is one of the reasons why these optimistic scenarios never materialized.

When the movie and book of "2001 A Space Odyssey" made their appearance in 1968, the possibility of a sequel had never crossed my mind. But in 1979 a mission to Jupiter really did take place, and we obtained our first close-ups of the giant planet and its astonishing family of moons.

The Voyager space-probes* were, of course, unmanned, but the images they sent back made real - and totally unexpected - worlds from what had hitherto been merely points of light in the most powerful telescopes. The continually erupting sulphur volcanoes of Io, the multiply-impacted face of Callisto, the weirdly contoured landscape of Ganymede - it was almost as if we had discovered a whole new Solar System. The temptation to explore it was irresistible; hence 2010 Odyssey Two, which also gave me the opportunity to find out what happened to David Bowman, after he had awakened in that enigmatic hotel room.

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* Which employed a 'slingshot' or 'gravity-assist' manoeuvre by flying close to Jupiter

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In 1981, when I started writing the new book, the Cold War was still in progress, and I felt I was going out on a limb - as well as risking criticism - by showing a joint US-Russian mission. I also underlined my hope of future co-operation by dedicating the novel to Nobelist Andrei Sakharov (then still in exile) and Cosmonaut Alexei Leonov - who, when I told him in 'Star Village' that the ship would be named after him, exclaimed, with typical ebullience, 'Then it will be a good ship!'

It still seems incredible to me that, when Peter Hyams made his excellent film version in 1983, he was able to use the actual close-ups of the Jovian moons obtained in the Voyager missions (some of them after helpful computer processing by the Jet Propulsion Laboratory, source of the originals). However, far better images were expected from the ambitious Galileo mission, due to carry out a detailed survey of the major satellites over a period of many months. Our knowledge of this new territory, previously obtained only from a brief flyby, would be enormously expanded - and I would have no excuse for not writing "Odyssey Three".

Alas - something tragic on the way to Jupiter. It had been planned to launch Galileo from the Space Shuttle in 1986 - but the Challenger disaster ruled out that option, and it soon became clear - precisely as was done by Discovery in the book version of 2001 - that we would get no new information from Io and Europa, Ganymede and Callisto, for at least another decade.

I decided not to wait, and the (1985) return of Halley's Comet to the inner Solar System gave me an irresistible theme. Its next appearance in 2061 would be good timing for a third Odyssey, though as I was not certain when I could deliver it I asked my publisher for a rather modest advance. It is with much sadness that I quote the dedication of "2061 Odyssey Three":

TO THE MEMORY OF
JUDY-LYNN DEL REY,
EDITOR EXTRAORDINARY,

who bought this book for one dollar
- but never knew if she got her money's worth.

Obviously there is no way in which a series of four science-fiction novels, written over a period of more than thirty years of the most breathtaking developments in technology (especially in space exploration) and politics, could be mutually consistent. As I wrote in the introduction to 2061: 'Just as 2010 was not a direct sequel to 2001, so this book is a not a linear sequel to 2010. They must all be considered as variations on the same theme, involving many of the same characters and situations, but not necessarily happening in the same universe.' If you want a good analogy from another medium, listen to what Rachmaninoff and Andrew Lloyd Webber did to the same handful of notes by Paganini.

So this "Final Odyssey" has discarded many of the elements of its precursors, but developed others - and I hope more important ones - in much greater detail. And if any readers of the earlier books feel disorientated by such transmutations, I hope I can dissuade them from sending me angry letters of denunciation by adapting one of the more endearing remarks of a certain US President: 'It's fiction, stupid!'

And it's all my own fiction, in case you hadn't noticed. Though I have much enjoyed my collaborations with Gentry Lee,* Michael Kube-McDowell and the late Mike McQuay - and won't hesitate again to call on the best hired guns in the business if I have future projects that are too big to handle myself - this particular Odyssey had to be a solo job.

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* By an unlikely coincidence, Gentry was Chief Engineer on the Galileo and Viking projects. (See Introduction to Rama II). It wasn't his fault that the Galileo antenna didn't unfurl...

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So every word is mine: well, almost every word, I must confess that I found Professor Thirugnanasampanthamoorthy (Chapter 35) in the Colombo Telephone Directory; I hope the present owner of that name will not object to the loan.

There are also a few borrowings from the great Oxford English Dictionary. And what do you know - to my delighted surprise, I find it uses no fewer than 66 quotations from my own books to illustrate the meaning and use of words!

Dear OED, if you find any useful examples in these pages, please be my guest - again.

I apologize for the number of modest coughs (about ten, at last count) in this Afterword; but the matters to which they drew attention seemed too relevant to be omitted.

Finally, I would like to assure my many Buddhist, Christian, Hindu, Jewish and Muslim friends that I am sincerely happy that the religion which Chance has given you has contributed to your peace of mind (and often, as Western medical science now reluctantly admits, to your physical well-being).

Perhaps it is better to be un-sane and happy, than sane and un-happy. But it is best of all to be sane and happy.

Whether our descendants can achieve that goal will be the greatest challenge of the future. Indeed, it may well decide whether we have any future.

Arthur C. Clarke
Colombo, Sri Lanka
19 September 1996

Armaments Race
Arthur C. Clarke
1954 Popular Publications Inc.

As I've remarked on previous occasions, no-one has ever succeeded in pinning-down Harry Purvis, prize raconteur of the "White Hart", for any length of time. Of his scientific knowledge there can be no doubt-but where did he pick it up? And what justification is there for the terms of familiarity with which he speaks of so many Fellows of the Royal Society? There are, it must be admitted, many who do not believe a single word he says. That, I feel, is going a little too far, as I recently remarked somewhat forcibly to Bill Temple.

"You're always gunning for Harry," I said, "but you must admit that he provides entertainment. And that's more than most of us can say."

"If you're being personal," retorted Bill, still rankling over the fact that some perfectly serious stories had just been returned by an American editor on the grounds that they hadn't made him laugh, "step outside and say that again." He glanced through the window, noticed that it was still snowing hard, and hastily added, "Not today, then, but maybe sometime in the summer, if we're both here on the. Wednesday that catches it. Have another of your favorite shots of straight pineapple juice?"

"Thanks," I said. "One day I'll ask for a gin with it, just to shake you. I think I must be the only guy in the White Hart who can take it or leave it-and leaves it."

This was as far as the conversation got, because the subject of the discussion then arrived. Normally, this would merely have added fuel to the controversy, but as Harry had a. stranger with him we decided to be polite little boys.

"Hello, folks," said Harry. "Meet my friend Solly Blumberg. Best special effects man in Hollywood."

"Let's be accurate, Harry," said Mr. Blumberg sadly, in a voice that should have belonged to a whipped spaniel. "Not in Hollywood. out of Hollywood."

Harry waved the correction aside.

"All the better for you. Sol's come over here to apply his talents to the British film industry."

"There is a British film. industry?" said Solly anxiously. "No one seemed very sure round the studio."

"Sure there is. It's in a very flourishing condition, too. The Government piles on an entertainments tax that drives it to bankruptcy, then keeps it alive with whacking big grants. That's the way we do things in this country. Hey, Drew, where's the Visitor's Book? And a double for both of us. Solly's had a terrible time-he needs a bit of building up."

I cannot say that, apart from his hang-dog look, Mr. Blumberg had the appearance of a man who had suffered extreme hardships. He was neatly dressed in a Hart, Schaffner and Marx suit, and the points of his shirt collar buttoned down somewhere around the middle of his chest. That was thoughtful of them as they thus concealed something, but not enough, of his tie. I wondered what the trouble was. Not un-American activities again, I prayed: that would trigger off our pet communist, who at the moment was peaceably studying a chess-board in the corner.

We all made sympathetic noises and John said rather pointedly: "Maybe it'll help to get it off your chest. It will be such a change to hear someone else talking around here."

"Don't be so modest, John," cut in Harry promptly. "I'm not tired of hearing you yet. But I doubt if Solly feels much like going through it again. Do you, old man?"

"No," said Mr. Blumberg. "You tell them."
("I knew it would come to that," sighed John in my ear.)
"Where shall I begin?" asked Harry. "The time Lillian Ross came to interview you?"
"Anywhere but there," shuddered Solly. "It really started when we were making the first 'Captain Zoom' serial."
"'Captain Zoom'?" said someone ominously. "Those are two

very rude words in this place. Don't say you were responsible for that unspeakable rubbish!"
"Now boys!" put in Harry in his best oil-on-troubled-waters voice. "Don't be too harsh. We can't apply our own high standards of criticism to everything. And people have got to earn a living. Besides, millions of kids like Captain Zoom. Surely you wouldn't want to break their little hearts-and so near Xmas, too!"
"If they really liked Captain Zoom, I'd rather break their little necks."
"Such unseasonable sentiments! I really must apologize for some of my compatriots, Solly. Let's see, what was the name of the first serial?"
"'Captain Zoom and the Menace from Mars'."
"Ali yes, that's right. Incidentally, I wonder why we always are menaced by Mars? I suppose that man Wells started it. One day we may have a big interplanetary libel action on our hands-unless we can prove that the Martians have been equally rude about us.
"I'm very glad to say that I never saw 'Menace From Mars' ("I did;" moaned somebody in the background. "I'm still trying to forget it.")-but we are not concerned with the story, such as it was. That was written by three men in a bar on Wilshire Boulevard. No-one is sure whether the Menace came out the way it did because the script writers were drunk, or whether they had to keep drunk in order to face the Menace. If that's confusing, don't bother. All that Solly was concerned with were the special effects that the director demanded.
"First of all, he had to build Mars. To do this he spent half an hour with 'The Conquest of Space', and then emerged with a sketch which the carpenters turned into an over-ripe orange floating in nothingness, with an improbable number of stars around it. That was easy. The Martian cities weren't so simple. You try and think of completely alien architecture that still makes sense. I doubt if it's possible-if it will work at all, someone's already used it here on Earth. What the studio finally built was vaguely Byzantine with touches of Frank Lloyd Wright. The fact that none of the doors led anywhere didn't really matter, as long as there was enough room on the sets for the swordplay and general acrobatics that the script demanded.
"Yes-swordplay. Here was a civilization which had atomic power, death-rays, spaceships, television and suchlike modem conveniences, but when it came to a fight between Captain Zoom and the evil Emperor Klugg, the clock went back a couple of centuries. A lot of soldiers stood round holding deadly-looking ray-guns, but they never did anything with them. Well, hardly ever. Sometimes a shower of sparks would chase Captain Zoom and singe his pants, but that was all. I suppose that as the rays couldn't very well move faster than light, he could always outrun them.
"Still, those ornamental ray-guns gave everyone quite a few headaches. It's funny how Hollywood will spend endless trouble on some minute detail in a film which is complete rubbish. The director of Captain Zoom had a thing about ray-guns. Solly designed the Mark 1, that looked like a cross between a bazooka and a blunderbuss. He was quite satisfied with it, and so was the director-for about a day. And then the great man came raging into the studio carrying a revolting creation of purple plastic with knobs and lenses and levers.
"'Lookit this, Solly!' he puffed. 'Junior got it down at the Supermarket-they're being given away with packets of Crunch. Collect ten lids, and you get one. Hell, they're better than ours! And they work!'

"He pressed a lever, and a thin stream of water shot across the set and disappeared behind Captain Zoom's spaceship, where it promptly extinguished a cigarette that had no right to be burning there. An angry stage-hand emerged through the airlock, saw who it was had drenched him, and swiftly retreated, muttering things about his Union.
"Solly examined the ray-gun with annoyance and yet with an expert's discrimination. Yes, it was certainly much more impressive than anything he'd put out. He retired into his office and promised to see what he could do about it.
"The Mark 11 had everything built into it, including a television screen. If Captain Zoom was suddenly confronted by a charging hickoderm, all he had to do was to switch on the set, wait for the tubes to warm up, check the channel selector, adjust the fine tuning, touch up the focus, twiddle with the Line and Frame holds-and then press the trigger. He was, fortunately, a man of unbelievably swift reactions.
"The director was impressed, and the Mark 11 went into production. A slightly different model, the Mark Ila, was built for the Emperor Klugg's diabolical cohorts. It would never do, of course, if both sides had the same weapon. I told you that Pandemic Productions were sticklers for accuracy.
"All went well until the first rushes, and even beyond. While the cast was acting, if you can use that word, they had to point the guns and press the triggers as if something was really happening. The sparks and flashes, however, were put on the negative later by two little men in a darkroom about as well guarded as Fort Knox. They did a good job, but after a while the producer again felt twinges in his overdeveloped artistic conscience.
"'Solly,' he said,, toying with the plastic horror which had reached Junior by courtesy of Crunch, the Succulent Cereal-Not a Burp in a Barrel-'Solly, I still want a gun that does something.'
"Solly ducked in time, so the jet went over his head and baptized a photograph of Louella Parsons.
"'You're not going to start shooting all over again!' he wailed.
"'Nooo,' replied the producer, with obvious reluctance. 'We'll have to use what we've got. But it looks faked, somehow.' He ruffled through the script on his desk, then brightened up.
"'Now next week we start on Episode 54-"Slaves of the SlugMen." Well, the Slug-:Men gotta have guns, so what I'd like you to do is this-'
"The Mark III gave Solly a lot of trouble. (I haven't missed out one yet, have I? Good.) Not only had it to be a completely new design, but as you'll have gathered it had to 'do something'. This was a challenge to Solly's ingenuity: however, if I may borrow from Professor Toynbee, it was a challenge that evoked the appropriate response.
"Some high-powered engineering went into the Mark III. Luckily, Solly knew an ingenious technician who'd helped him out on similar occasions before, and he was really the man behind it. ('I'll say he was!' said Mr. Blumberg gloomily.) The principle was to use a jet of air, produced by a small but extremely powerful electric fan, and then to spray finely divided powder into it. When the thing was adjusted correctly, it shot out a most impressive beam, and made a still more impressive noise. The actors were so scared of it that their performances became most realistic.
"The producer was delighted-for a full three days. Then a dreadful doubt assailed him.
11 'Solly,' he said, 'those damn guns are too good. The Slug-Men can beat the pants off Captain Zoom. Well have to give him something better!
I "it was at this point that Solly realized what had happened. He had become involved in an armaments race.
"Let's see, this brings us to the Mark IV, doesn't it? How did that work?-oh yes, I remember. It was a glorified oxy-acetylene burner, with various chemicals

injected into it to produce the most beautiful flames. I should have mentioned that from Episode 50'Doom on Deimos'-the studio had switched over from black and white to Murkicolor, and great possibilities were thus opened up. By squirting copper or strontium or barium into the jet, you could get any colour you wanted.
"If you think that by this time the producer was satisfied, you don't know Hollywood. Some cynics may still laugh when the motto 'Ars Gratia Artis' flashes on the screen, but this attitude, I submit, is not in accordance with the facts. Would such old fossils as Michelangelo, Rembrandt or Titian have spent so much time, effort and money on the quest for perfection as did Pandemic Productions? I think not.
"I don't pretend to remember all the Marks that Solly and his ingenious engineer friend produced during the course of the serial. There was one that shot out a stream of coloured smoke-rings. There was the high-frequency generator that produced enormous but quite harmless sparks. There was a particularly ingenious curved beam produced by a jet of water with light reflected along inside it, which looked most spectacular in the dark. And finally, there was the Mark 12."
"Mark 13," said Mr. Blumberg.
"Of course-how stupid of me! What other number could it have been! The Mark 13 was not actually a portable weapon though some of the others were portable only by a considerable stretch of the imagination. It was the diabolical device to be installed on Phobos in order to subjugate Earth. Though Solly has explained them to me once, the scientific principles involved escape my simple mind . . . . However, who am I to match my brains against the intellects responsible for Captain Zoom? I can only

report what the ray was supposed to do, not how it did it. It was to start a chain reaction in the atmosphere of our unfortunate planet, making the nitrogen and the oxygen in the air combine with highly deleterious effects to terrestrial life., -
"I'm not sure whether to be sorry or glad that Solly left all the details of the fabulous Mark 13 to his talented assistant. Though I've questioned him at some length, all he can tell me is that the thing was about six feet high and looked like a cross between the 200 inch telescope and an anti-aircraft gun. That's not very helpful, is it?
,,He also says that there were a lot of radio tubes in the brute, as we'll as a thundering great magnet. And it was definitely supposed to produce a harmless but impressive electric arc, which could be distorted into all sorts of interesting shapes by the magnet. That was what the inventor said, and, despite everything, there is still no reason to disbelieve him.
"By one of those mischances that later turns out to be providential, Solly wasn't at the studio when they tried out the Mark 13. To his great annoyance, he had to be down in Mexico that day. And wasn't that lucky for you, Solly! He was expecting a long-distance call from one of his friends in the afternoon, but when it came through it wasn't the kind of message he'd anticipated.
"The Mark 13 had been, to put it mildly, a success. No-one knew exactly what had happened, but by a miracle no lives had been lost and the fire department had been able to save the adjoining studios. It was incredible, yet the facts were beyond dispute. The Mark 13 was supposed to be a phony death-ray-and it had turned out to be a real one. Something had emerged from the projector, and gone through the studio wall as if it wasn't there. Indeed, a moment later it wasn't. There was just a great big hole, beginning to smolder round the edges. And then the roof fell in . . . .
"Unless Solly could convince the F.B.I. that it was all a mistake, he'd better stay the other side of the border. Even now the Pentagon and the Atomic Energy Commission were converging upon the wreckage . . . .
"What would you have done in Solly's shoes? He was innocent, but how could he prove it? Perhaps he would have gone back to face the music if he hadn't

remembered that he'd once hired a man who'd campaigned for Henry Wallace, back in '48. That might take
some explaining away: besides, Solly was a little tired of Captain Zoom. So here he is. Anyone know of a British film company that might have an opening for him? But historical films only, please. He won't touch anything more up-to-date than cross-bows."

Breaking Strain

Arthur C. Clarke
1949

Originally Published as "Thirty Seconds - Thirty Days"

Grant was writing up the Star Queen's log when he heard the cabin door opening behind him. He didn't bother to look round-it was hardly necessary for there was only one other man aboard the ship. But when nothing happened, and when McNeil neither spoke nor came into the room, the long silence finally roused Grant's curiosity and he swung the seat round in its gimbals.

McNeil was just standing in the doorway, looking as if he had seen a ghost. The trite metaphor flashed into Grant's mind instantly. He did not know for a moment how near the truth it was. In a sense McNeil had seen a ghost-the most terrifying of all ghosts -his own.

"What's the matter?" said Grant angrily. "You sick or something?"

The engineer shook his head. Grant noticed the little beads of sweat that broke away from his forehead and went glittering across the room on their perfectly straight trajectories. His throat muscles moved, but for a while no sound came. It looked as though he was going to cry.

"We're done for," he whispered at last. "Oxygen reserve's gone."

Then he did cry. He looked like a flabby doll, slowly collapsing on itself. He couldn't fall, for there was no gravity, so he just folded up in mid-air.

Grant said nothing. Quite unconsciously he rammed his smoldering cigarette into the ash tray, grinding it viciously until the last tiny spark had died. Already the air seemed to be thickening
around him as the oldest terror of the spaceways gripped him by
the throat.

He slowly loosed the elastic straps which, while he was seated, gave some illusion of weight, and with an automatic skill launched himself toward the doorway. McNeil did not offer to follow. Even making every allowance for the shock he had undergone, Grant felt that he was behaving very badly. He gave the engineer an angry cuff as he passed and told him to snap out of it.

The hold was a large hemispherical room with a thick central column which carried the controls and cabling to the other half of the dumbbell-shaped spaceship a hundred meters away. It was packed with crates and boxes arranged in a surrealistic three-dimensional array that made very few concessions to gravity.

But even if the cargo had suddenly vanished Grant would scarcely have noticed. He. had eyes only for the big oxygen tank, taller than himself, which was bolted against the wall near the inner door of the airlock.

It was just as he had last seen it, gleaming with aluminum paint, and the metal sides still held the faint touch of coldness that gave the only hint of the contents. All the piping seemed in perfect condition. There was no sign of anything wrong apart from one minor detail. The needle of the contents gauge lay mutely against the zero stop.

Grant gazed at that silent symbol as a man in ancient London, returning home one evening at the time of the Plague, might have stared at a rough cross newly scrawled upon his door. Then he banged half a dozen times on the glass in the futile hope that the needle had stuck-though he never really doubted its message. News that is sufficiently bad somehow carries its own guarantee of truth. Only good reports need confirmation.

When Grant got back to the control room, McNeil was himself again. A glance at the opened medicine chest showed the reason for the engineer's rapid recovery. He even assayed a faint attempt at humor.
"It was a meteor," he said. "They tell us a ship this size should get hit once a century. We seem to have jumped the gun with ninety-five years still to go.,,
"But what about the alarms? The air pressure's normal-how could we have been holed?"

"We weren't," McNeil replied. "You know how the oxygen circulates night-side through the refrigerating coils to keep it liquid? The meteor must have smashed them and the stuff simply boiled away."
Grant was silent, collecting his thoughts. What had happened was serious-deadly serious-but it need not be fatal. After an, the voyage was more than three quarters over.
"Surely the regenerator can keep the air breathable, even if it does get pretty thick?" he asked hopefully.
McNeil shook his head. "I've not worked it out in detail, but I know the answer. When the carbon dioxide is broken down and the free oxygen gets cycled back there's a loss of about ten per cent. That's why we have to carry a reserve."
"The space-suits!" cried Grant in sudden excitement. "What about their tanks?"
He had spoken without thinking, and the immediate realization of his mistake left him feeling worse than before.
"We can't keep oxygen in them-it would boil off in a few days. There's enough compressed gas there for about thirty minutes merely long enough for you to get to the main tank in an emergency."
"There must be a way out-even if we have to jettison cargo and run for it. Let's stop guessing and work out exactly where we are."
Grant was as much angry as frightened. He was angry with McNeil for breaking down. He was angry with the designers of the ship for not having foreseen this God-knew-how-many-million-to-one chance. The deadline might be a couple of weeks away and a lot could happen before then. The thought helped for a moment to keep his fears at arm's length.
This was an emergency, beyond doubt, but it was one of those peculiarly protracted emergencies that seem to happen only in space. There was plenty of time to think-perhaps too much time.
Grant strapped himself in the pilot's seat and pulled~ out a writing-pad.
"Let's get the facts right," he said with artificial calmness. "We've got the air that's still circulating in the ship and we lose ten per cent of the oxygen every time it goes through the generator. Chuck me over the Manual, will you? I can never remember how many cubic meters we use a day."
In saying that the Star Queen might expect to be hit by a meteor once every century, McNeil had grossly but unavoidably oversimplified the problem. For the answer depended on so many factors that three generations of statisticians had done little but lay down rules so vague that the insurance companies still shivered with apprehension when the great meteor showers went sweeping like a gale through the orbits of the inner worlds.
Everything depends, of course, on what one means by the word meteor. Each lump of cosmic slag that reaches the surface of the Earth has a million smaller brethren that perish utterly in the no man's-land where the atmosphere has not quite ended and space has yet to begin-that ghostly region where the weird Aurora sometimes walks by night.
These are the familiar shooting stars, seldom larger than a pin's head, and these in turn are outnumbered a million fold again by particles too small to leave any visible trace of their dying as they drift down from the sky. All of them, the countless specks of dust, the rare boulders and even the wandering mountains that Earth encounters perhaps once every million years-all of them are meteors.

For the purposes of space-flight, a meteor is only of interest if, on penetrating the hull of a ship, it leaves a hole large enough to be dangerous. This is a matter of relative speeds as well as size. Tables have been prepared showing approximate collision times for various parts of the Solar System-and for various sizes of meteors down to masses of a few milligrams.

That which had struck the Star Queen was a giant, being nearly a centimeter across and weighing all of ten grams. According to the table the waiting-time for collision with such a monster was of the order of ten to the ninth days-say three million years. The virtual certainty that such an occurrence would not happen again in the course of human history gave Grant and McNeil very little consolation.

However, things might have been worse. The Star Queen was 115 days on her orbit and had only 30 still to go. She was traveling, as did all freighters, on the long tangential ellipse kissing the orbits of Earth and Venus on opposite sides of the Sun. The fast liners could cut across from planet to planet at three times her speed and ten times her fuel consumption-but she must plod along her predetermined track like a streetcar, taking 145 days, more or less, for each journey.

Anything more unlike the early-twentieth-century idea of a spaceship than the Star Queen would be hard to imagine. She consisted of two spheres, one fifty and the other twenty meters in diameter, joined by a cylinder about a hundred meters long. The whole structure looked like a match-stick-and-Plasticine model of a hydrogen atom. Crew, cargo, and controls were in the larger sphere, while the smaller one held the atomic motors and was-to put it mildly-out of bounds to living matter.

The Star Queen had been built in space and could never have lifted herself even from the surface of the Moon. Under full power her ion drive could produce an acceleration of a twentieth of a gravity, which in an hour would give her all the velocity she needed to change from a satellite of the Earth to one of Venus. Hauling cargo up from the planets was the job of the powerful little chemical rockets. In a month the tugs would be climbing up from Venus to meet her, but the Star Queen would not be stopping for there would be no one at the controls. She would continue blindly on her orbit, speeding past Venus at miles a second-and five months later she would be back at the orbit of the Earth, though Earth itself would then be far away.

It is surprising how long it takes to do a simple addition when your life depends on the answer. Grant ran down the short column of figures half a dozen times before he finally gave up hope that the total would change. Then he sat doodling nervously on the white plastic of the pilot's desk.

"With all possible economies," he said, "we can last about twenty days. That means we'll be ten days out of Venus when.

His voice trailed off into silence.

Ten days didn't sound much-but it might just as well have been ten years. Grant thought sardonically of all the hack adventure writers who had used just this situation in their stories and radio serials. In these circumstances, according to the carbon-copy experts-few of whom had ever gone beyond the Moon-there were three things that could happen.

The popular solution-which had become almost a cliché-was to turn the ship into a glorified greenhouse or a hydroponic farm
and let photosynthesis do the rest. Alternatively one could perform prodigies of chemical or atomic engineering-explained in tedious technical detail-and build an oxygen manufacturing plant which would not only save your life-and of course the heroine's-but also make you the owner of fabulously valuable patents. The third or deus ex machina solution was the arrival of a convenient spaceship which happened to be matching your course and velocity exactly.

But that was fiction and things were different in real life. Although the first idea was sound in theory there wasn't even a packet of grass seed aboard the

Star Queen. As for feats of inventive engineering, two men-however brilliant and however desperate were not likely to improve in a few days on the work of scores of great industrial research organizations over a full century.

The spaceship that "happened to be passing" was, almost by definition, impossible. Even if other freighters had been coasting on the same elliptic path-and Grant knew there were none-then by the very laws that governed their movements they would always keep their original separations. It was not quite impossible that a liner, racing on its hyperbolic orbit, might pass within a few hundred thousand kilometers of them-but at a speed so great that it would be as inaccessible as Pluto.

"If we threw out the cargo," said McNeil at last, "would we have a chance of changing our orbit?"

Grant shook his head.

"I'd hoped so," he replied, "but it won't work. We could reach Venus in a week if we wished-but we'd have no fuel for braking and nothing from the planet could catch us as we went past."

"Not even a liner?"

"According to Lloyd's Register Venus has only a couple of freighters at the moment. In any case it would be a practically impossible maneuver. Even if it could match our speed how would the rescue ship get back? It would need about fifty kilometers a second for the whole job!"

"If we can't figure a way out," said McNeil, "maybe someone on Venus can. We'd better talk to them."

"I'm going to," Grant replied, "as soon as I've decided what to say. Go and get the transmitter aligned, will you?"

He watched McNeil as he floated out of the room. The engineer was probably going to give trouble in the days that lay ahead. Until

now they had got on well enough-like most stout men McNeil was good-natured and easygoing. But now Grant realized that he lacked fiber. He had become flabby-physically and mentally living too long in space.

A buzzer sounded on the transmitter switchboard. The parabolic mirror out on the hull was aimed at the gleaming arc-lamp of Venus, only ten million kilometers away and moving on an almost parallel path. The three-millimeter waves from the ship's transmitter would make the trip in little more than half a minute. There was bitterness in the knowledge that they were only thirty seconds from safety.

The automatic monitor on Venus gave its impersonal Go ahead signal and Grant began to talk steadily, and he hoped, quite dispassionately. He gave a careful analysis of the situation and ended with a request for advice. His fears concerning McNeil he left unspoken. For one thing he knew that the engineer would be monitoring him at the transmitter.

As yet no one on Venus would have heard the message, even though the transmission time4ag was over. It would still be coiled up in the recorder spools, but in a few minutes an unsuspecting signal officer would arrive to play it over.

He would have no idea of the bombshell that was about to burst, triggering trains of sympathetic ripples on all the inhabited worlds as television and newssheet took up the refrain. An accident in space has a dramatic quality that crowds all other items from the headlines.

Until now Grant had been too preoccupied with his own safety to give much thought to the cargo in his charge. A sea captain of ancient times, whose first thought was for his ship, might have been shocked by this attitude. Grant, however, had reason on his side.

The Star Queen could never founder, could never run upon uncharted rocks or pass silently, as so many ships have passed, forever from the knowledge of man. She was safe, whatever might befall her crew. If she was undisturbed she would

continue to retrace her orbit with such precision that men might set their calendars by her for centuries to come.
The cargo, Grant suddenly remembered, was insured for over twenty million dollars. There were not many goods valuable enough
to be shipped from world to world and most of the crates in the hold were worth more than their weight-or rather their mass-in gold. Perhaps some items might be useful in this emergency and Grant went to the safe to find the loading schedule.
He was sorting the thin, tough sheets when McNeil came back into the cabin.
"I've been reducing the air pressure," he said. "The hull shows some leaks that wouldn't have mattered in the usual way."
Grant nodded absently as he passed a bundle of sheets over to McNeil.
"Here's our loading schedule. I suggest we both run through it in case there's anything in the cargo that may help."
if it did nothing else, he might have added, it would at least give them something to occupy their minds.
As he ran down the long columns of numbered items-a complete cross-section of interplanetary commerce-Grant found himself wondering what lay behind these inanimate symbols. item 347 - 1 book - 4 kilos gross.
He whistled as he noticed that it was a staffed item, insured for a hundred thousand dollars, and he suddenly remembered hearing on the radio that the Hesperian Museum had just bought a first edition Seven Pillars of Wisdom.
A few sheets later was a very contrasting item, Miscellaneous books - 25 kilos - no intrinsic value.
It had cost a small fortune to ship those books to Venus, yet they were of "no intrinsic value." Grant let his imagination loose on the problem. Perhaps someone who was leaving Earth forever was taking with him to a new world his most cherished treasures-the dozen or so volumes that above all others had most shaped his mind.
Item 564 - 12 reels film.
That, of course, would be the Neronian super-epic, While Rome Burns, which had left Earth just one jump ahead of the censor. Venus was waiting for it with considerable impatience.
Medical supplies - 50 kilos. Case of cigars - I kilo. Precision instruments - 75 kilos. So the list went on. Each item was something rare or something which the industry and science of a younger civilization could not yet produce.
The cargo was sharply divided into two classes-blatant luxury or sheer necessity. There was little in between. And there was

nothing, nothing at all, which gave Grant the slightest hope. He did not see how it could have been otherwise, but that did not prevent him from feeling a quite unreasonable disappointment.
The reply from Venus, when it came at last, took nearly an hour to run through the recorder. It was a questionnaire so detailed that Grant wondered morosely if he'd live long enough to answer it. Most of the queries were technical ones concerning the ship. The experts on two planets were pooling their brains in the attempt to save the Star Queen and her cargo.
"Well, what do you think of it?" Grant asked McNeil when the other had finished running through the message. He was watching the engineer carefully for any further sign of strain.
There was a long pause before McNeil spoke. Then he shrugged his shoulders and his first words were an echo of Grant's own thoughts.
"It will certainly keep us busy. I won't be able to do all these tests in under a day. I can see what they're driving at most of the time, but some of the questions are just plain crazy."
Grant had suspected that, but said nothing as the other continued.

"Rate of hull leakage-that's sensible enough, but why should anyone want to know the efficiency of our radiation screening? I think they're trying to keep up our morale by pretending they have some bright ideas-or else they want to keep us too busy to worry."

Grant was relieved and yet annoyed by McNeil's calmness relieved because he had been afraid of another scene and annoyed because McNeil was not fitting at all neatly into the mental category he had prepared for him. Was that first momentary lapse typical of the man or might it have happened to anyone?

Grant, to whom the world was very much a place of blacks and whites, felt angry at being unable to decide whether McNeil was cowardly or courageous. That he might be both was a possibility that never occurred to him.

There is a timelessness about space-flight that is unmatched by any other experience of man. Even on the Moon there are shadows that creep sluggishly from crag to crag as the sun makes its slow march across the sky. Earthward there is always the great clock of the spinning globe, marking the hours with continents for hands.

But on a long voyage in a gyro-stabilized ship the same patterns of sunlight lie unmoving on wall or floor as the chronometer ticks off its meaningless hours and days.

Grant and McNeil had long since learned to regulate their lives accordingly. In deep space they moved and thought with a leisureliness that would vanish quickly enough when a voyage was nearing its end and the time for braking maneuvers had arrived. Though they were now under sentence of death, they continued along the well-worn grooves of habit.

Every day Grant*carefully wrote up the log, checked the ship's position and carried out his various routine duties. McNeil was also behaving normally as far as could be told, though Grant suspected that some of the technical maintenance was being carried out with a very light hand.

It was now three days since the meteor had struck. For the last twenty-four hours Earth and Venus had been in conference and Grant wondered when he would hear the result of their deliberations. He did not believe that the finest technical brains in the Solar System could save them now, but it was hard to abandon hope when everything still seemed so normal and the air was still clean and fresh.

On the fourth day Venus spoke again. Shorn of its technicalities, the message was nothing more or less than a funeral oration. Grant and McNeil had been written off, but they were given elaborate instructions concerning the safety of the cargo.

Back on Earth the astronomers were computing all the possible rescue orbits that might make contact with the Star Queen in the next few years. There was even a chance that she might be reached from Earth six or seven months later, when she was back at aphelion, but the maneuver could be carried out only by a fast liner with no payload and would cost a fortune in fuel.

McNeil vanished soon after this message came through. At first Grant was a little relieved. If McNeil chose to look after himself that was his own affair. Besides there were various letters to write though the last-will-and-testament business could come later.

It was McNeil's turn to prepare the "evening" meal, a duty he enjoyed for he took good care of his stomach. When the usual

sounds from the galley were not forthcoming Grant went in search of his crew. He found McNeil lying in his bunk, very much at peace with the universe. Hanging in the air beside him was a large metal crate which had been roughly forced open. Grant had no need to examine it closely to guess its contents. A glance at McNeil was enough.

"It's a dirty shame," said the engineer without a trace of embarrassment, "to suck this stuff up through a tube. Can't you put on some 'g' so that we can drink it properly?"

Grant stared at him with angry contempt, but McNeil returned his gaze unabashed. "Oh, don't be a sourpuss! Have some yourself-what does it matter now?"

He pushed across a bottle and Grant fielded it deftly as it floated by. It was a fabulously valuable wine-he remembered the consignment now-and the contents of that small crate must be worth thousands.

"I don't think there's any need," said Grant severely, "to behave like a pig-even in these circumstances."

McNeil wasn't drunk yet. He had only reached the brightly lighted anteroom of intoxication and had not lost all contact with the drab outer world.

"I am prepared," he said with great solemnity, "to listen to any good argument against my present course of action-a course which seems eminently sensible to me. But you'd better convince me quickly while I'm still amenable to reason."

He pressed the plastic bulb again and a purple jet shot into his mouth.

"Apart from the fact that you're stealing Company property which will certainly be salvaged sooner or later-you can hardly stay drunk for several weeks."

"That," said McNeil thoughtfully, "remains to be seen."

"I don't think so," retorted Grant. Bracing himself against the wall, he gave the crate a vicious shove that sent it flying through the open doorway.

As he dived after it and slammed the door he heard McNeil shout, "Well, of all the dirty tricks!"

It would take the engineer some time-particularly in his present condition-to unbuckle himself and follow. Grant steered the crate
back to the hold and locked the door. As there was never any need to lock the hold when the ship was in space McNeil wouldn't have a key for it himself and Grant could hide the duplicate that was kept in the control cabin.

McNeil was singing when, some time later, Grant went back past his room. He still had a couple of bottles for company and was shouting:

"We don't care where the oxygen goes If it doesn't get into the wine.

Grant, whose education had been severely technical, couldn't place the quotation. As he paused to listen he suddenly found himself shaken by an emotion which, to do him justice, he did not for a moment recognize.

It passed as swiftly as it had come, leaving him sick and trembling. For the first time, he realized that his dislike of McNeil was slowly turning to hatred.

It is a fundamental rule of space-flight that, for sound psychological reasons, the minimum crew on a long journey shall consist of not less than three men.

But rules are made to be broken and the Star Queen's owners had obtained full authority from the Board of Space Control and the insurance companies when the freighter set off for Venus without her regular captain.

At the last moment he had been taken ill and there was no replacement. Since the planets are disinclined to wait upon man and his affairs, if she did not sail on time she would not sail at all.

Millions of dollars were involved-so she sailed. Grant and McNeil were both highly capable men and they had no objection At all to earning double their normal pay for very little extra work. Despite fundamental differences in temperament, they got on well enough in ordinary circumstances. It was nobody's fault that circumstances were now very far from ordinary.

Three days without food, it is said, is long enough to remove most of the subtle differences between a civilized man and a savage. Grant and McNeil were still in no physical discomfort. But their imaginations had been only too active and they now had more in

common with two hungry Pacific Islanders in a lost canoe than either would have cared to admit.

For there was one aspect of the situation, and that the most important of all, which had never been mentioned. When the last figures on Grant's writing-pad had been checked and rechecked, the calculation was still not quite complete. Instantly each man had made the one further step, each had arrived simultaneously at the same unspoken result.

It was terribly simple-a macabre parody of those problems in first-year arithmetic that begin, "If six men take two days to assemble five helicopters, how long . . .

The oxygen would last two men for about twenty days, and Venus was thirty days away. One did not have to be a calculating prodigy to see at once that one man, and one man only, might yet live to walk the metal streets of Port Hesperus.

The acknowledged deadline was twenty days ahead, but the unmentioned one was only ten days off. Until that time there would still be enough air for two men-and thereafter for one man only for the rest of the voyage. To a sufficiently detached observer the situation would have been very entertaining.

It was obvious that the conspiracy of silence could not last much longer. But it is not easy, even at the best of times, for two people to decide amicably which one of them shall commit suicide. It is still more difficult when they are no longer on speaking terms.

Grant wished to be perfectly fair. Therefore the only thing to do was to wait until McNeil sobered up and then to put the question to him frankly. He could think best at his desk, so he went to the control cabin and strapped himself down in the pilot's chair.

For a while he stared thoughtfully into nothingness. It would be better, he decided, to broach the matter by correspondence, especially while diplomatic relations were in their present state. He clipped a sheet of note-paper on the writing-pad and began, "Dear McNeil . . . " Then he tore it out and started again, "McNeil . . . "

It took him the best part of three hours and even then he wasn't wholly satisfied. There were some things it was so darned difficult to put down on paper. But at last he managed to finish. He sealed the letter and locked it away in his safe. It could wait for a day or two.

Few of the waiting millions on Earth and Venus could have any idea of the tensions that were slowly building up aboard the Star Queen. For days press and radio had been full of fantastic rescue schemes. On three worlds there was hardly any other topic of conversation. But only the faintest echo of the planet-wide tumult reached the two men who were its cause.

At any time the station on Venus could speak to the Star Queen, but there was so little that could be said. One could not with any decency give words of encouragement to men in the condemned cell, even when there was some slight uncertainty about the actual date of execution.

So Venus contented itself with a few routine messages every day and blocked the steady stream of exhortations and newspaper offers that came pouring in from Earth. As a result private radio companies on Earth made frantic attempts to contact the Star Queen directly. They failed, simply because it never occurred to Grant and McNeil to focus their receiver anywhere except on Venus, now so tantalizingly near at hand.

There had been an embarrassing interlude when McNeil emerged from his cabin, but though relations were not particularly cordial, life aboard the Star Queen continued much as before.

Grant spent most of his waking hours in the pilot's position, calculating approach maneuvers and writing interminable letters to his wife. He could have spoken to her had he wished, but the thought of all those millions of waiting ears had prevented him from doing so. Interplanetary speech circuits were supposed to be private-but too many people would be interested in this one.

In a couple of days, Grant assured himself, he would hand his letter to McNeil and they could decide what was to be done. Such a delay would also give McNeil a

chance of raising the subject himself. That he might have other reasons for his hesitation was something Grant's conscious mind still refused to admit.
He often wondered how McNeil was spending his time. The engineer had a large library of microfilm books, for he read widely and his range of interests was unusual. His favorite book, Grant knew, was Jurgen and perhaps even now he was trying to forget his doom by losing himself in its strange magic. Others of McNeil's books were less respectable and not a few were of the class curiously described as "curious."

The truth of the matter was that McNeil was far too subtle and complicated a personality for Grant to understand. He was a hedonist and enjoyed the pleasures of life all the more for being cut off from them for months at a time. But he was by no means the moral weakling that the unimaginative and somewhat puritanical Grant had supposed.
It was true that he had collapsed completely under the initial shock and that his behavior over the wine was-by Grant's standards -reprehensible. But McNeil had had his breakdown and had recovered. Therein lay the difference between him and the hard but brittle Grant.
Though the normal routine of duties had been resumed by tacit consent, it did little to reduce the sense of strain. Grant and McNeil avoided each other as much as possible except when mealtimes brought them together. When they did meet, they behaved with an exaggerated politeness as if each were striving to be perfectly normal-and inexplicably failing.
Grant had hoped that McNeil would- himself broach the subject of suicide, thus sparing him a very awkward duty. When the engineer stubbornly refused to do anything of the sort it added to Grant's resentment and contempt. To make matters worse he was now suffering from nightmares and sleeping very badly.
The nightmare was always the same. When he was a child it had often happened that at bedtime he had been reading a story far too exciting to be left until morning. To avoid detection he had continued reading under the bedclothes by flashlight, curled up in a snug white-walled cocoon. Every ten minutes or so the air had become too stifling to breathe and his emergence into the delicious cool air had been a major part of the fun.
Now, thirty years later, these innocent childhood hours returned to haunt him. He was dreaming that he could not escape from the suffocating sheets while the air was steadily and remorselessly thickening around him.
He had intended to give McNeil the letter after two days, yet somehow he put it off again. This procrastination was very unlike Grant, but he managed to persuade himself that it was a perfectly reasonable thing to do.
He was giving McNeil a chance to redeem himself-to prove that he wasn't a coward by raising the matter himself. That McNeil
might be waiting for him to do exactly the same thing somehow never occurred to Grant.
The all-too-literal deadline was only five days off when, for the first time, Grant's mind brushed lightly against the thought of murder. He had been sitting after the "evening" meal, trying to relax as McNeil clattered around in the galley with, he considered, quite unnecessary noise.
What use, he asked himself, was the engineer to the world? He had no responsibilities and no family-no one would be any the worse off for his death. Grant, on the other hand, had a wife and three children of whom he was moderately fond, though for some obscure reason they responded with little more than dutiful affection.
Any impartial judge would have no difficulty in deciding which of them should survive. If McNeil had a spark of decency in him he would have come to the same conclusion already. Since he appeared to have done nothing of the sort he had forfeited all further claims to consideration.

Such was the elemental logic of Grant's subconscious mind, which had arrived at its answer days before but had only now succeeded in attracting the attention for which it had been clamoring. To Grant's credit he at once rejected the thought with horror.

He was an upright and honorable person with a very strict code of behavior. Even the vagrant homicidal impulses of what is misleadingly called "normal" man had seldom ruffled his mind. But in the days-the very few days-left to him, they would come more and more often.

The air had now become noticeably fouler. Though there was still no real difficulty in breathing, it was a constant reminder of what lay ahead, and Grant found that it was keeping him from sleep. This was not pure loss, as it helped to break the power of his nightmares, but he was becoming physically run down. His nerve was also rapidly deteriorating, a state of affairs accentuated by the fact that McNeil seemed to be behaving with unexpected and annoying calmness. Grant realized that he had come to the stage when it would be dangerous to delay the showdown any longer.

McNeil was in his room as usual when Grant went up to the control cabin to collect the letter he had locked away in the safe-

it seemed a lifetime ago. He wondered if he need add anything more to it. Then he realized that this was only another excuse for delay. Resolutely he made his way toward McNeil's cabin.

A single neutron begins the chain-reaction that in an instant can destroy a million lives and the toil of generations. Equally insignificant and unimportant are the trigger-events which can sometimes change a man's course of action and so alter the whole pattern of his future.

Nothing could have been more trivial than that which made Grant pause in the corridor outside McNeil's room. In the ordinary way he would not even have noticed it. It was the smell of smoke-tobacco smoke.

The thought that the sybaritic engineer had so little self-control that he was squandering the last precious liters of oxygen in such a manner filled Grant with blinding fury. He stood for a moment quite paralyzed with the intensity of his emotion.

Then slowly, he crumpled the letter in his hand. The thought which had first been an unwelcome intruder, then a casual speculation, was at last fully accepted. McNeil had had his chance and had proved, by his unbelievable selfishness, unworthy of it. Very well-he could die.

The speed with which Grant had arrived at this conclusion would not have deceived the most amateurish of psychologists. It was relief as much as hatred that drove him away from McNeil's room. He had wanted to convince himself that there would be no need to do the honorable thing, to suggest some game of chance that would give them each an equal probability of life.

This was the excuse he needed, and he had seized upon it to salve his conscience. For though he might plan and even carry out a murder, Grant was the sort of person who would have to do it according to his own particular moral code.

As it happened he was-not for the first time-badly misjudging McNeil. The engineer was a heavy smoker and tobacco was quite essential to his mental well-being even in normal circumstances. How much more, essential it was now, Grant, who only smoked occasionally and without much enjoyment, could never have appreciated.

McNeil had satisfied himself by careful calculation that four cigarettes a day would make no measurable difference whatsoever to
the ship's oxygen endurance, whereas they would make all the difference in the world to his own nerves and hence indirectly to Grant's.

But it was no use explaining this to Grant. So he had smoked in private and with a self-control he found agreeably, almost voluptuously, surprising. It was sheer bad luck that Grant had detected one of the day's four cigarettes.

For a man who had only at that moment talked himself into murder, Grant's actions were remarkably methodical. Without hesitation, he hurried back to the control room and opened the medicine chest with its neatly labeled compartments, designed for almost every emergency that could occur in space.

Even the ultimate emergency had been considered, for there behind its retaining elastic bands was the tiny bottle he had been seeking, the image of which had been lying hidden far down in the unknown depths of his mind through all these days. It bore a white label carrying a skull-and-crossbones, and beneath them the words: Approx. one-half gram will cause painless and almost instantaneous death.

The poison was painless and instantaneous-that was good. But even more important was a fact unmentioned on the label. It was also tasteless.

The contrast between the meals prepared by Grant and those organized with considerable skill and care by McNeil was striking. Anyone who was fond of food and who spent a good deal of his life in space usually learned the art of cooking in self-defense. McNeil had done this long ago.

To Grant, on the other hand, eating was one of those necessary but annoying jobs which had to be got through as quickly as possible. His cooking reflected this opinion. McNeil had ceased to grumble about it, but he would have been very interested in the trouble Grant was taking over this particular meal.

If he noticed any increasing nervousness on Grant's part as the meal progressed, he said nothing. They ate almost in silence, but that was not unusual for they had long since exhausted most of the possibilities of light conversation. When the last dishes-deep bowls with in-turned rims to prevent the contents drifting out-had been cleared away, Grant went into the galley to prepare the coffee.

He took rather a long time, for at the last moment something quite maddening and quite ridiculous happened. He suddenly recalled one of the film classics of the last century in which the fabulous Charlie Chaplin tried to poison an unwanted wife-and then accidentally changed the glasses.

No memory could have been more unwelcome, for it left him shaken with a gust of silent hysteria. Poe's Imp of the Perverse, that demon who delights in defying the careful canons of self-preservation, was at work and it was a good minute before Grant could regain his self-control.

He was sure that, outwardly at least, he was quite calm as he carried in the two plastic containers and their drinking tubes. There was no danger of confusing them, for the engineer's had the letters MAC painted boldly across it.

At the thought Grant nearly relapsed into psychopathic giggles but just managed to regain control with the somber reflection that his nerves must be in even worse condition than he had imagined.

He watched, fascinated, though without appearing to do so, as McNeil toyed with his cup. The engineer seemed in no great hurry and was staring moodily into space. Then he put his lips to the drinking tube and sipped.

A moment later he spluttered slightly-and an icy hand seemed to seize Grant's heart and hold it tight. Then McNeil turned to him and said evenly, "You've made it properly for once. It's quite hot."

Slowly, Grant's heart resumed its interrupted work. He did not trust himself to speak, but managed a noncommittal nod. McNeil parked the cup carefully in the air, a few inches away from his face.

He seemed very thoughtful, as if weighing his words for some important remark. Grant cursed himself for having made the drink so hot-that was just the sort of detail that hanged murderers. If McNeil waited much longer he would probably betray himself through nervousness.

"I suppose," said McNeil in a quietly conversational sort of way, "it has occurred to you that there's still enough air to last one of us to Venus?"
Grant forced his jangling nerves under control and tore his eyes away from that hypnotic cup. His throat seemed very dry as he answered, "It-it had crossed my mind."
McNeil touched his cup, found it still too hot and continued thoughtfully, "Then wouldn't it be more sensible if one of us decided to walk out of the airlock, say-or to take some of the poison in there?" He jerked his thumb toward the medicine chest, just visible from where they were sitting.
Grant nodded.
"The only trouble, of course," added the engineer, "is to decide which of us will be the unlucky one. I suppose it would have to be by picking a card or in some other quite arbitrary way."
Grant stared at McNeil with a fascination that almost outweighed his mounting nervousness. He had never believed that the engineer could discuss the subject so calmly. Grant was sure he suspected nothing. Obviously McNeil's thoughts had been running on parallel lines to his own and it was scarcely even a coincidence that he had chosen this time, of all times, to raise the matter.
McNeil was watching him intently, as if judging his reactions.
"You're right," Grant heard himself say. "We must talk it over."
"Yes," said McNeil quite impassively. "We must." Then he reached for his cup again, put the drinking tube to his lips and sucked slowly.
Grant could not wait until he had finished. To his surprise the relief he had been expecting did not come. He even felt a stab of regret, though it was not quite remorse. It was a little late to think of it now, but he suddenly remembered that he would be alone~ in the Star Queen, haunted by his thoughts, for more than three weeks before rescue came.
He did not wish to see McNeil die, and he felt rather sick. Without another glance at his victim he launched himself toward the exit.
Immovably fixed, the fierce sun and the unwinking stars looked down upon the Star Queen, which seemed as motionless as they. There was no way of telling that the tiny dumbbell of the ship had now almost reached her maximum speed and that millions of horsepower were chained within the smaller sphere, waiting for the moment of its release. There was no way of telling, indeed, that she carried any life at all.
An airlock on the night-side of the ship slowly opened, letting a blaze of light escape from the interior. The brilliant circle looked

very strange hanging there in the darkness. Then it was abruptly eclipsed as two figures floated out of the ship.
One was much bulkier than the other, and for a rather important reason-it was wearing a space-suit. Now there are some forms of apparel that may be worn or discarded as the fancy pleases with no other ill-effects than a possible loss of social prestige. But spacesuits are not among them.
Something not easy to follow was happening in the darkness. Then the smaller figure began to move, slowly at first but with rapidly mounting speed. It swept out of the shadow of the ship into the full blast of the sun, and now one could see that strapped to its back was a small gas-cylinder from which a fine mist was jetting to vanish almost instantly into space.
It was a crude but effective rocket. There was no danger that the ship's minute gravitational pull would drag the body back to it again.
Rotating slightly, the corpse dwindled against the stars and vanished from sight in less than a minute. Quite motionless, the figure in the airlock watched it go. Then the outer door swung shut, the circle of brilliance Vanished and only the pale Earthlight still glinted on the shadowed wall of the ship.
Nothing else whatsoever happened for twenty-three days.
The captain of the Hercules turned to his mate with a sigh of relief.

"I was afraid he couldn't do it. It must have been a colossal job to break his orbit single-handed-and with the air as thick as it must be by now. How soon can we get to him?"
"It will take about an hour. He's still got quite a bit of eccentricity but we can correct that."
"Good. Signal the Leviathan and Titan that we can make contact and ask them to take off, will you? But I wouldn't drop any tips to your news commentator friends until we're safely locked."
The mate had the grace to blush. "I don't intend to," he said in a slightly hurt voice as he pecked delicately at the keys of his calculator. The answer that flashed instantly on the screen seemed to displease him.
"We'd better board and bring the Queen down to circular speed ourselves before we call the other tugs," he said, "otherwise we'll
be wasting a lot of fuel. She's still got a velocity excess of nearly a kilometer a second."
"Good idea-tell Leviathan and Titan to stand by but not to blast until we give them the new orbit."
While the message was on its way down through the unbroken cloudbanks that covered half the sky below, the mate remarked thoughtfully, "I wonder what he's feeling like now?"
"I can tell you. He's so pleased to be alive that he doesn't give a hoot about anything else."
"Still, I'm not sure I'd like to have left my shipmate in space so that I could get home."
"It's not the sort of thing that anyone would like to do. But you heard the broadcast-they'd talked it over calmly and the loser went out of the airlock. It was the only sensible way."
"Sensible, perhaps-but it's pretty horrible to let someone else sacrifice himself in such a cold-blooded way so that you can live."
"Don't be a ruddy sentimentalist. I'll bet that if it happened to us you'd push me out before I could even say my prayers."
"Unless you did it to me first. Still, I don't think it's ever likely to happen to the Hercules. Five days out of port's the longest we've ever been, isn't it? Talk about the romance of the spaceways!"
The captain didn't reply. He was peering into the eyepiece of the navigating telescope, for the Star Queen should now be within optical range. There was a long pause while he adjusted the vernier controls. Then he gave a little sigh of satisfaction.
"There she is-about nine-fifty kilometers away. Tell the crew to stand by-and send a message to cheer him up. Say we'll be there in thirty minutes even if it isn't quite true."
Slowly the thousand-meter nylon ropes yielded beneath the strain as they absorbed the relative momentum of the ships, then slackened again as the Star Queen and the Hercules rebounded ' toward each other. The electric winches began to turn and, like a spider crawling up its thread, the Hercules drew alongside the freighter.
Men in space-suits sweated with heavy reaction units-tricky work, this-until the airlocks had registered and could be coupled together. The outer doors slid aside and the air in the locks mingled, fresh with foul. As the mate of the Hercules waited, oxygen cylinder

in hand, he wondered what condition the survivor would be in. Then the Star Queen's inner door slid open.
For a moment, the two men stood looking at each other across the short corridor that now connected the two airlocks. The mate was surprised and a little disappointed to find that he felt no particular sense of drama.

So much had happened to make this moment possible that its actual achievement was almost an anticlimax, even in the instant when it was slipping into the past. He wished-for he was an M*curable romantic-that he could think of something memorable to say, some "Doctor Livingstone, I presume?" phrase that would pass into history.

But all he actually said was, "Well, McNeil, I'm pleased to see you.))

Though he was considerably thinner and somewhat haggard, McNeil had stood the ordeal well. He breathed gratefully the blast of raw oxygen and rejected the idea that he might like to lie down and sleep. As he explained, he had done very little but sleep for the last week to conserve air. The first mate looked relieved. He had been afraid he might have to wait for the story.

The cargo was being trans-shipped and the other two tugs were climbing up from the great blinding crescent of Venus while McNeil retraced the events of the last few weeks and the mate made surreptitious notes.

He spoke quite calmly and impersonally, as if he were relating some adventure that had happened to another person, or indeed had never happened at all. Which was, of course, to some extent the case, though it would be unfair to suggest that McNeil was telling any lies.

He invented nothing, but he omitted a good deal. He had had three weeks in which to prepare his narrative and he did not think it had any flaws . . . .

Grant had already reached the door when McNeil called softly after him, "What's the hurry? I thought we had something to discuss."

Grant grabbed at the doorway to halt his headlong flight. He turned slowly and stared unbelievingly at the engineer. McNeil

should be already dead-but he was sitting quite comfortably, looking at him with a most peculiar expression.

"Sit down," he said sharply-and in that moment it suddenly seemed that all authority had passed to him. Grant did so, quite without volition. Something had gone wrong, though what it was he could not imagine.

The silence in the control room seemed to last for ages. Then McNeil said rather sadly, "I'd hoped better of you, Grant."

At last Grant found his voice, though he could barely recognize it.

,,What do you mean?" he whispered.

"What do you think I mean?" replied McNeil, with what seemed no more than mild irritation. "This little attempt of yours to poison me, of course."

Grant's tottering world collapsed at last, but he no longer cared greatly one way or the other. McNeil began to examine his beautifully kept fingernails with some attention.

"As a matter of interest," he said, in the way that one might ask the time, "when did you decide to kill me?"

The sense of unreality was so overwhelming that Grant felt he was acting a part, that this had nothing to do with real life at all.

"Only this morning," he said, and believed it.

"Hmm," remarked McNeil, obviously without much conviction. He rose to his feet and moved over to the medicine chest. Grant's eyes followed him as he fumbled in the compartment and came back with the little poison bottle. It still appeared to be full. Grant had been careful about that.

"I suppose I should get pretty mad about this whole business," McNeil continued conversationally, holding the bottle between thumb and forefinger. "But somehow I'm not'. Maybe it's because I never had many illusions about human nature. And, of course, I saw it coming a long time ago."

Only the last phrase really reached Grant's consciousness.

"You-saw it coming?"

"Heavens, yes! You're too transparent to make a good criminal, I'm afraid, And now that your little plot's failed it leaves us both in an embarrassing position, doesn't it?"

To this masterly understatement there seemed no possible reply.

"By rights," continued the engineer thoughtfully, "I should now

work myself into a good temper, call Venus Central, and denounce you to the authorities. But it would be a rather pointless thing to do, and I've never been much good at losing my temper anyway. Of course, you'll say that's because I'm too lazy-but I don't think so."

He gave Grant a twisted smile.

"Oh, I know what you think about me-you've got me neatly classified in that orderly mind of yours, haven't you? I'm soft and self-indulgent, I haven't any moral courage-or any morals for that matter-and I don't give a damn for anyone but myself. Well, I'm not denying it. Maybe it's ninety per cent true. But the odd ten per cent is mighty important, Grant!"

Grant felt in no condition to indulge in psychological analysis, and this seemed hardly the time for anything of the sort. Besides, he was still obsessed with the problem of his failure and the mystery of McNeil's continued existence. McNeil, who knew this perfectly well, seemed in no hurry to satisfy his curiosity.

"Well, what do you intend to do now?" Grant asked, anxious to get it over.

"I would like," said McNeil calmly, "to carry on our discussion where it was interrupted by the coffee."

"You don't mean-"

"But I do. Just as if nothing had happened."

"That doesn't make sense. You've got something up your sleeve!" cried Grant.

McNeil sighed. He put down the poison bottle and looked firmly at Grant.

"You're in no position to accuse me of plotting anything. To repeat my earlier remarks, I am suggesting that we decide which one of us shall take poison-only we don't want any more unilateral decisions. Also"-he picked up the bottle again-"it will be the real thing this time. The stuff in here merely leaves a bad taste in the mouth."

A light was beginning to dawn in Grant's mind. "You changed the poison!"

"Naturally. You may think you're a good actor, Grant, but frankly-from the balcony-I thought the performance stank. I could tell you were plotting something, probably before you knew it yourself. In the last few days I've deloused the ship pretty thoroughly. Thinking of all the ways you might have done me in was quite amusing and helped to pass the time. The poison was so obvious that it was the first thing I fixed. But I rather overdid the danger signals and nearly gave myself away when I took the first sip. Salt doesn't go at all well with coffee."

He gave that wry grin again. "Also, I'd hoped for something more subtle. So far I've found fifteen infallible ways of murdering anyone aboard a spaceship. But I don't propose to describe them now."

This was fantastic, Grant thought. He was being treated, not like a criminal, but like a rather stupid schoolboy who hadn't done his homework properly.

"Yet you're still willing," said Grant unbelievingly, "to start all over again? And you'd take the poison yourself if you lost?"

McNeil was silent for a long time. Then he began, slowly, "I can see that you still don't believe me. It doesn't fit at all nicely into your tidy little picture, does it? But perhaps I can make you understand. It's really quite simple.

"I've enjoyed life, Grant, without many scruples or regrets-but the better part of it's over now and I don't cling to what's left as desperately as you might imagine. Yet while I am alive I'm rather particular about some things.

"It may surprise you to know that I've got any ideals at all. But I have, Grant-I've always tried to act like a civilized, rational being. I've not always succeeded. When I've failed I've tried to redeem myself."

He paused, and when he resumed it was as though be, and not Grant, was on the defensive. "I've never exactly Eked you, Grant, but I've often admired you and

that's why I'm sorry it's come to, this. I admired you most of all the day the ship was holed."

For the first time, McNeil seemed to have some difficulty in choosing his words. When he spoke again he avoided Grant's eyes.

"I didn't behave very well then. Something happened that I thought was impossible. I've always been quite sure that I'd never lose my nerve but-well-it was so sudden it knocked me over."

He attempted to hide his embarrassment by humor. "The same sort of thing happened on my very first trip. I was sure I'd never be space sick-and as a result I was much worse than if I had not been overconfident. But I got over it then-and again this time. It

was one of the biggest surprises of my life, Grant, when I saw that you of all people were beginning to crack.

"Oh, yes-the business of the wines! I can see you're thinking about that. Well, that's one thing I don't regret. I said I'd always tried to act like a civilized man-and a civilized man should always know when to get drunk. But perhaps you wouldn't understand."

Oddly enough, that was just what Grant was beginning to do. He had caught his first real glimpse of McNeil's intricate and tortuous personality and realized how utterly he had misjudged him. No-misjudged was not the right word. In many ways his judgment had been correct. But it had only touched the surface-he had never suspected the depths that lay beneath.

I In a moment of insight that had never come before, and from the nature of things could never come again, Grant understood the reasons behind McNeil's action. This was nothing so simple as a coward trying to reinstate himself in the eyes of the world, for no one need ever know what happened aboard the Star Queen.

In any case, McNeil probably cared nothing for the world's opinion, thanks to the sleek self-sufficiency that had so often annoyed Grant. But that very self-sufficiency meant that at all costs he must preserve his own good opinion of himself. Without it life would not be worth living-and McNeil had never accepted life save on his own terms.

The engineer was watching him intently and must have guessed that Grant was coming near the truth, for he suddenly changed his tone as though he was sorry he had revealed so much of his character.

"Don't think I get a quixotic pleasure from turning the other cheek," he said. "Just consider it from the point of view of pure logic. After all, we've got to come to some agreement.

"Has it occurred to you that if only one of us survives without a covering message from the other, he'll have a very uncomfortable time explaining just what happened?"

In his blind fury, Grant had completely forgotten this. But he did not believe it bulked at all important in McNeil's own thoughts.

"Yes," he said, "I suppose you're right."

He felt far better now. All the hate had drained out of him and he was at peace. The truth was known and he accepted it.

That it was so different from what he had imagined did not seem to matter now.

"Well, let's get it over," he said unemotionally. "There's a new pack of cards lying around somewhere."

"I think we'd better speak to Venus first-both of us," replied McNeil, with peculiar emphasis. "We want a complete agreement on record in case anyone asks awkward questions later."

Grant nodded absently. He did not mind very much now one way or the other. He even smiled, ten minutes later, as he drew his card from the pack and laid it, face upward, beside McNeil's.

"So that's the whole story, is it?" said the first mate, wondering how soon he could decently get to the transmitter.
"Yes," said McNeil evenly, "that's all there was to it."
The mate bit his pencil, trying to frame the next question. "And I suppose Grant took it all quite calmly?"
The captain gave him a glare, which he avoided, and McNeil looked at him coldly as if he could see through to the sensation mongering headlines ranged behind. He got to his feet and moved over to the observation port.
"You heard his broadcast, didn't you? Wasn't that calm enough?"
The mate sighed. It still seemed hard to believe that in such circumstances two men could have behaved in so reasonable, so unemotional a manner. He could have pictured all sorts of dramatic possibilities-sudden outbursts of insanity, even attempts at murder. Yet according to McNeil nothing at all had happened. It was too bad.
McNeil was speaking again, as if to himself. "Yes, Grant behaved very well-very well indeed. It was a great pity-"
Then he seemed to lose himself in the ever-fresh, incomparable glory of the approaching planet. Not far beneath, and coming closer by kilometers every second, the snow-white crescent arms of Venus spanned more than half the sky. Down there were life and warmth and civilization-and air.
The future, which not long ago had seemed contracted to a point, had opened out again into all its unknown possibilities and wonders. But behind him McNeil could sense the eyes of his rescuers, probing, questioning-yes, and condemning too.

All his life he would hear whispers. Voices would be saying behind his back, "Isn't that the man who-?"
He did not care. For once in his life at least, he had done something of which he could feel unashamed. Perhaps one day his own pitiless self-analysis would strip bare the motives behind his actions, would whisper in his ear. "Altruism? Don't be a fool! You did it to bolster up your own good opinion of yourself-so much more important than anyone else's!"
But the perverse maddening voices, which all his life had made nothing seem worthwhile, were silent for the moment and he felt content. He had reached the calm at the center of the hurricane, While it lasted he would enjoy it to the full.

Childhoods End
by
Arthur C Clarke

1
EARTH AND THE OVERLORDS

THE volcano that had reared Taratua up from the Pacific depths had been sleeping now for half a million years. Yet in a little while, thought Reinhold, the island would be bathed with fires fiercer than any that had attended its birth. He glanced towards the launching site, and his gaze dimbed the pyramid of scaffolding that still surrounded the Columbus. Two hundred feet above the ground, the ship's prow was catching the last rays of the descending sun. This was one of the last nights it would ever know: soon it would be floating in the eternal sunahine of space.

It was quiet here beneath the palms, high up on the rocky spine of the island. The only sound from the Project was the occasional yammering of an air compressor or the faint shout of a workman. Reinhold had grown fond of these clustered palms; almost every evening he had come here to survey his little empire. It saddened him to think that they would be blasted to atoms when the Columbus rose in flame and fury to the stars.

A mile beyond the reef, the James Forrestal had switched on her searchlights and was sweeping the dark waters. The sun had now vanished completely, and the swift tropical night was racing In from the east. Reinhold wondered, a little sardonically, if the carrier expected to find Russian submarines so close to shore.

The thought of Russia turned his mind, as it always did, to Konrad, and that morning in the cataclysmic spring of 1945. More than thirty years had passed, but the memory of those last days when the Reich was crumbling beneath the waves from the East and from the West had never faded. He could still see Konrad's tired blue eyes, and the golden stubble on his chin, as they shook hands and parted in that ruined Prussian village, while the refugees streamed endlessly past. It was

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a parting that symbolized everything that had since happened to the world-the cleavage between East and West. For Konrad chose the road to Moscow. Reinhold had thought him a fool, but now he was not so sure.

For thirty years he had assumed that Konrad was dead. It was only a week ago that Colonel Sandmeyer, of Technical Intelligence, had given him the news. He didn't like Sand-meyer, and he was sure the feeling was mutual. But neither let that interfere with business.

"Mr. Hoffmann," the Colonel had begun, in his best official manner, "I've just had some alarming information from Washington. It's top secret, of course, but we've decided to break it to the engineering staff so that they'll realize the necessity fbr speed." He paused for effect, but the gesture was wasted on Reinhold. Somehow, he already knew what was coming.

"The Russians are nearly level with us. They've got some kind of atomic drive-it may even be more efficient than ours, and they're building a ship on the shores of Lake Baikal. We don't know how far they've got, but Intelligence believe it may be launched this year. You know what that means."

Yes, thought Reinhold, I know. The race is on-and we may not win it.

"Do you know who's running their team?" he had asked, not really expecting an answer. To his surprise, Colonel Sand-meyer had pushed across a typewritten sheet-and there at its head was the name: Konrad Schneider.

"You knew a lot of these men at PeenemOnde, didn't you?" said the Colonel. "That may give us some insight into their methods. I'd like you to let me have notes on as many of them as you can-their specialities, the bright ideas they had, and so on. I know it's asking a lot after all this time-but see what you can do."
"Konrad Schneider is the only one who matters," Reinhold had answered. "He was brilliant-the others are just competent engineers. Heaven only knows what he's done in thirty years. Remember-he's probably seen all our results and we haven't any of his. That gives him a decided advantage."
He hadn't meant this as a criticism of Intelligence, but for a moment is seemed as if Sandmeyer was going to be offended. Then the Colonel shrugged his shoulders.
"It works both ways-you've told me that yourself. Our free exchange of information means swifter progress, even if
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we do give away a few secrets. The Russian research departments probably don't know what their own people are doing half the time. We'll show them that Democracy can get to the moon first."
Democracy-Nuts! thought Reinhold, but knew better than to say it. One Konrad Schneider was worth a million names on an electoral roll. And what had Konrad done by this time, with all the resources of the U.S.S.R. behind him? Perhaps, even now, his ship was already outward bound from Earth....

The sun which had deserted Taratua was still high above Lake Baikal when Konrad Schneider and the Assistant Commissar for Nuclear Science walked slowly back from the motor test rig. Their ears were still throbbing painfully, though the last thunderous echoes had died out across the lake ten minutes before.
"Why the long face?" asked Grigorievitch suddenly. "You should be happy now. In another month we'll be on our way, and the Yankees will be choking themselves with rage."
"You're an optimist, as usual," said Schneider. "Even though the motor works, it's not as easy as that. True, I can't see any serious obstacles now-but I'm worried about the reports from Taratua. I've told you how good Hoffmann is, and he's got billions of dollars behind him. Those photographs of his ship aren't very clear, but it looks as if it's not far from completion. And we know he tested his motor five weeks ago."
"Don't worry," laughed Grigorievitch. "They're the ones who are going to have the big surprise. Remember-they don't know a thing about us."
Schneider wondered if that was true, but decided it was much safer to express no doubts. That might start Grigorievitch's mind exploring far too many tortuous channels, and if there had been a leak, he would find it hard enough to clear hiinself
The guard saluted as he reentered the administration buildmg. There were nearly as many soldiers here, he thought grimly, as technicians. But that was how the Russians did things, and as long as they kept out of his way he had no complaints. On the whole-with exasperating exceptions-events bad turned out very much as he had hoped. Only the future could tell if he or Reinhold had made the better choice.
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He was already at work on his final report when the sound of shouting voices disturbed hint. For a moment he sat motionless at his desk, wondering what conceivable event could have disturbed the rigid discipline of the camp. Then he walked to the window-and for the first time in his life he knew despair.

The stars were all around him as Reinhold descended the little hill. Out at sea, the Forrestal was still sweeping the water with her fingers of light, while

further along the beach the scaffolding round the Columbus had transformed itself into an illuminated Christmas tree. Only the projecting prow of the ship lay like a dark shadow across the stars.

A radio was blaring dance-music from the living quarters, and unconsciously Reinhold's feet accelerated to the rhythm.

He had almost reached the narrow road along the edge of the sands when some premonition, some half-glimpsed movement, made him stop. Puzzled, he glanced from land to sea and back again: it was some little time before he thought of looking at the sky.

Then Reinhold Hoffmann knew, as did Konrad Schneider at this same moment, that he had lost his race. And he knew that he had lost it, not by the few weeks or months that he had feared, but by millennia. The huge and silent shadows driving across the stars, more miles above his head than he dared to guess, were as far beyond his little Columbus as it surpassed the log canoes of paleolithic man.

For a moment that seemed to last forever, Reinhold watched, as all the world was watching, while the great ships descended in their overwhelming majesty-until at last he could hear the faint scream of their passage through the thin air of the 8tratosphere.

He felt no regrets as the work of a lifetime was swept away. He had laboured to take men to the stars, and in the moment of success the stars-the aloof, indifferent stars-had come to him. This was the moment when history held its breath, and the present sheared asunder from the past as an iceberg splits from its frozen, parent cliffs, and goes sailing out to sea in lonely pride. All that the past ages had achieved was as nothbig now: only one thought echoed and re-echoed through Reinhold's brain:

The human race was no longer alone.

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2

Tii~ Secretary-General of the United Nations stood motionless by the great window, staring down at the crawling traffic on 43rd Street. He sometimes wondered if it was a good thing for any man to work at such an altitude above his fellow humans. Detachment was all very well, but it could change so easily to indifference. Or was he merely trying to rationalize his dislike of skyscrapers, still unabated after twenty years in New York?

He heard the door open behind him, but did not turn his head as Pieter van Ryberg came into the room. There was the inevitable pause as Pieter looked disapprovingly at the thermostat, for it was a standing joke that the Secretary-General liked living in an icebox. Stormgren waited until his assistant joined hint at the window, then tore his gaze away from the familiar yet always fascinating panorama below.

"They're late," he said. 'Wainwright should have been here five minutes ago."

"I've just heard from the police. He's got quite a procession with him, and it's snarled up the traffic. He should be here any moment now."

Van Ryberg paused, then added abruptly, "Are you still sure it's a good idea to see him?"

"I'm afraid it's a little late to back out of it now. After all, I've agreed-though as you know it was never my idea in the first place."

Stormgren had walked to his desk and was fidgeting with his famous uranium paperweight. He was not nervous- merely undecided. He was also glad that Wainwright was late, for that would give him a slight moral advantage when the interview opened. Such trivialities played a greater part in human affairs than anyone who set much store on logic and reason might wish.

"Here they are!" said van Ryberg suddenly, pressing his face against the window. "They're coming along the Avenue

-a good three thousand, I'd say."

Stormgren picked up his notebook and rejoined his assistant. Half a'mile away, a small but determined crowd was moving slowly towards the Secretariat Building. It carried banners that were indecipherable at this distance, but Stormgren knew
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their message well enough. ~Presently he could hear, rising above the sound of the traffic, the ominous rhythm of chanting voices. He felt a sudden wave of disgust sweep over him. Surely the world had had enough of marching mobs and angry slogans!

The crowd had now come abreast of the building: it must know that he was watching, for here and there fists were being shaken, rather self-consciously, in the air. They were not defying him, though the gesture was doubtless meant for Stormgren to see. As pygmies may threaten a giant, so those angry fists were directed against the sky fifty kilometres above his head-against the gleaming silver cloud that was the flagship of the Overlord fleet.

And very probably, thought Stormgren, Karellen was watching the whole thing and enjoying himself hugely, for this meeting would never have taken place except at the Supervisor's instigation.

This was the first time that Stormgren had ever met the head of the Freedom League. He had ceased to wonder if the action was wise, for Kareilen's plans were often too subtle for merely human understanding. At the worst, Stormgren did not see that any positive harm could be done. If he had refused to see Wainwright, the L~ague would have used the fact as ammunition against him.

Alexander Wainwright was a tall, handsome man in the late forties. He was, Stormgren knew, completely honest, and therefore doubly dangerous. Yet his obvious sincerity made it hard to dislike him, whatever views one might have about the cause for which he stood-and some of the followers he had attracted.

Stormgren wasted no time after van Ryberg's brief and somewhat strained introductions.

"I suppose," he began, "the chief object of your visit is to register a formal protest against the Federation Scheme. Am I correct?"

Wainwright nodded gravely.

"That is my main protest, Mr. Secretary. As you know, for the last five years we have tried to awaken the human race to the danger that confronts it. The task has been a difficult one, for the majority of people seem content to let the Overlords run the world as they please. Nevertheless, more than five million patriots, in every country, have signed our petition."
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"That is not a very impressive figure out of two and a half billion."

"It is a figure that cannot be ignored. And for every person who has signed, there are many who feel grave doubts about the wisdom, not to mention the rightness of this Federation plan. Even Supervisor Karellen, for all his powers, cannot wipe out a thousand years of history at the stroke of a pen."

"What does anyone know of Karellen's powers?" retorted Stormgren. "When I was a boy, the Federation of Europe was a dream-but when I grew to manhood it had become reality. And that was before the arrival of the Overlords. Kardlen is merely finishing the work we had begun."

"Europe was a cultural and geographical entity. The world is not-that is the difference."

"To the Overlords," replied Stormgren sarcastically, "the Earth is probably a great deal smaller than Europe seemed to our fathers-and their outlook, I submit, is more mature than ours."

"I do not necessarily quarrel with Federation as an ulti mate objective-though many of my supporters might not agree. But it must come from within-not be superimposed from without. We must work out our own destiny. There must be no more interference in human affairs!"

Stormgren sighed. All this he had heard a hundred times before, and he knew that he could only give the old answer that the Freedom League had refused to accept.

He had faith in Karellen, and they had not. That was the fundamental difference, and there was nothing he could do about it. Luckily, there was nothing that the Freedom League could do, either.

"Let me ask you a few questions," he said. "Can you deny that the Overlords have brought security, peace and prosperity to the world?"

"That is true. But they have taken our liberty. Man does not live-"

"-by bread alone. Yes, I know-but this is the first age in which every man was sure of getting even that. In any case, what freedom have we lost compared with that which the Overlords have given us for the first time in human history?"

"Freedom to control our own lives, under God's guidance." At last, thought Stormgren, we've got to the point. Basically, the conflict is a religious one, however much it may be

disguised. Wainwright never let you forget he was a dergyman. Though he no longer wore a derical collar, somehow one always got the impression it was still there.

"Last month," pointed out Stormgren, "a hundred bishops, cardinals and rabbis signed a joint declaration pledging their support for the Supervisor's policy. The world'sreigions are against you."

Wainwright shook his head in angry deniaL

"Many of the leaders are blind: they have been corrupted by the Overlords. When they realize the danger, it may be too late. Hinmrnity will have lost its initiative and become a subject race."

There was silence for a moment. Then Stormgren replied:

"In three days I will be meeting the Supervisor again. I will explain your objections to him, since it is my duty to represent the views of the world. But it will alter nothing-I can assure you of that."

"There is one other point," said Wainwright slowly. "We have many objections to the Overlords-but above all we detest their secretiveness. You are the only human being who has ever spoken with Karellen, and even you have never seen him! Is it surprising that we doubt his motives?"

"Despite all that he has done for humanity?"

"Yes-despite that. I do not know which we resent more- Karellen's omnipotence, or his secrecy. If he has nothing to hide, why will he never reveal himself? Next time you speak with the Supervisor, Mr. Stormgren, ask him that!"

Stormgren was silent. There was nothing he could say to this-nothing, at any rate, that would convince the other. He sometimes wondered if he had really convinced himself.

It was, of course, only a very small operation from their point of view, but to Earth it was the biggest thing that had ever happened. There had been no warning when the great ships came pouring out of the unknown depths of space. Countless times this day had been described in fiction, but no-one had really believed that it would ever come. Now it had dawned at last: the gleaming, silent shapes hanging over every land were the symbol of a science Man could not hope to match for centuries. For six days they floated motionless above his cities, giving no hint they knew of his existence.

But none was needed: not by chance alone could those mighty ships have come to rest so precisely over New York, London, Paris, Moscow, Rome, Cape Town, Tokyo, Canberra....

Even before the ending of those heart-freezing days, some men had guessed the truth. This was not the first tentative contact by a race which knew nothing of man. Within those silent, unmoving ships, master psychologists were studying humanity's reactions. When the curve of tension had reached its peak, they would act.

A.nd on the sixth day Karellen, Supervisor for Earth, made himself known to the world in a broadcast that blanketed every radio frequency. He spoke in English so perfect that the controversy it began was to rage across the Atlantic for a generation. But the context of the speech was more staggering even than its delivery. By any standards, it was a work of superlative genius, showing a complete and absolute mastery of human affairs. There could be no doubt that its scholarship and virtuosity, its tantali7ing glimpses of knowledge still untapped were deliberately designed to convince mankind that it was in the presence of overwhelming intellectual power. When Karellen had finished, the nations of Earth knew that their days of precarious sovereignty had ended. Local, internal governments would still retain their powers, but in the wider field of international affairs the supreme decisions had passed from human hands. Arguments-protests-all were futile.

It was hardly to be expected that all the nations of the world would submit tamely to such a limitation of their powers. Yet active resistance presented baffling difficulties, for the destruction of the Overlords' ships, even if it could be achieved, would annihilate the cities beneath them. Nevertheless, one major power had made the attempt. Perhaps those responsible hoped to kill two birds with one atomic missile, for their target was floating above the capital of an adjoining and unfriendly nation.

As the great ship's image had expanded on the television screen in the secret control room, the little group of officers and technicians must have been torn by many emotions. If they succeeded-what action would the remaining ships take? Could they also be destroyed, leaving humanity to go its own way once more? Or would Kardllen wreak some frightful vengeance upon those who had attacked him? The screen became suddenly blank as the missile destroyed

itself on impact, and the picture switched immediately to an airborne camera many miles away. In the fraction of a second that had elapsed, the fireball should already have formed and should be filling the sky with its solar flame. Yet nothing whatsoever had happened. The great ship floated unharmed, bathed in the raw sunlight at the edge of space. Not only had the bomb failed to touch it, but no-one could ever decide what had happened to the missile. Moreover, Karellen took no action against those responsible, or~ even indicated that he had known of the attack. He ignored them contemptuously, leaving them to worry over a vengeance that never came. It was a more effective, and more demoralizing, treatment than any punitive action could have been. The government responsible collapsed completely in mutual recrimination a few weeks later.

There had also been some passive resistance to the policy of the Overlords. Usually, Karellen had been able to deal with it by letting those concerned have their own way, until they had discovered that they were only hurting themselves by their refusal to co-operate. Only once had he taken any direct action against a recalcitrant government.

For more than a hundred years, the Republic of South Africa had been the centre of social strife. Men of good will on both sides had tried to build a bridge, but in vain-fears and prejudices were too deeply ingrained to permit any cooperation. Successive governments had differed only by the degree of their intolerance; the land was poisoned with hate and the aftermath of civil war. When it became clear that no attempt would be made to end discrimination, K.arellen gave his warning. It merely named a date and time-no more. There was apprehension, but little fear or panic, for no-one believed that the Overlords would take any violent or destructive action which would involve innocent and guilty alike.

Nor did they. All that happened was that as the sun passed the meridian at Cape Town-it went out. There remained visible merely a pale, purple ghost, giving no heat or light. Somehow, out in space, the light of the sun had been polarized by

two crossed fields so that no radiation could pass. The area affected was five hundred kilometres across, and perfectly circular.
The demonstration lasted thirty minutes. It was sufficient:
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the next day the Government of South Africa announced that full civil rights would be restored to the white minority.
Apart from such isolated incidents, the human race had accepted the Overlords as part of the natural order of things. In a surprisingly short time, the initial shock had worn off, and the world went about its business again. The greatest change a suddenly awakened Rip Van Winkle would have noticed was a hushed expectancy, a mental glancing-over-the-shoulder, as mankind waited for the Overlords to show themselves and to step down from their gleaming ships.
Five years later, it was still waiting. That, thought Stormgren, was the cause of all the trouble.

There was the usual circle of sightseers, cameras at the ready, as Stormgren's car drove on to the launching-field. The Secretary-General exchanged a few final words with his assistant, collected his brief-case, and walked through the ring of spectators.
Karellen never kept him waiting for long. There was a sudden "Oh!" from the crowd, and a silver bubble expanded with breathtaking speed in the sky above. A gust of air tore at Stormgren's clothes as the tiny ship came to rest fifty metres away, floating delicately a few centimetres above the ground, as if it feared contamination with Earth. As he walked slowly forward, Stormgren saw that familiar puckering of the seamless metallic hull, and in a moment the opening that had so baffled the world's best scientists appeared before him. He stepped through it into the ship's single, softly-lit room. The entrance sealed itself as if it had never been, shutting out all sound and sight.
It opened again five minutes later. There had been no sensation of movement, but Stormgren knew that he was now fifty kilometres above the Earth, deep in the heart of Karellen's ship. Be was in the world of the Overlords: all around him, they were going about their mysterious business. He had come nearer to them than had any other man: yet he knew no more of their physical nature than did any of the millions on the world below.
The little conference room at the end of the short connecting corridor was unfurnished apart from the single chair and the table beneath the vision screen. As was intended, it told
15
absolutely nothing of the creatures who had built it. The vision screen was empty now, as it had always been. Sometimes in his dreams Stormgren had imagined that it had suddenly flashed into life, revealing the secret that tormented all the world. But the dream had never come true: behind that rectangle of darkness lay utter mystery. Yet there also lay power and wisdom, an immense and tolerant understanding of mankind-and, most unexpected of all, a humorous affection fbr the little creatures crawling on the planet beneath.
From the hidden grille came that calm, never-hurried voice that Stormgren knew so well though the world had heard it only once in history. Its depth and resonance gave the single clue that existed in Karellen's physical nature, fbr it left an overwhelming impression of sheer size. Karellen was large- perhaps much larger than a man. It was true that some scientists, after analyzing the record of his only speech, had suggested that the voice was that of a machine~ This was something that Stormgren could never believe.
"Yes, Rikki, I was listening to your little interview. What did you make of Mr. Wainwright?"
"He's an honest man, even if many of his supporters aren't. What are we going to do about him? The League itself isn't dangerous-but some of its extremists are

openly advocating violence. I've been wondering if I should put a guard on my house. But I hope it isn't necessary."
Kardlien evaded the point in the annoying way he sometimes had.
"The details of the World Federation have been out for a month now. Has there been a substantial increase in the seven per cent who don't approve of me-or the twelve per cent who Don't Know?"
"Not yet. But that's of no importance: what does worry me is a general feeling, even among your supporters, that it's time this secrecy came to an end."
Karellen's sigh was technically perfect, yet somehow lacked conviction.
"That's your feeling too, isn't it?"
The question was so rhetorical that Stormgren did not bother to answer it.
"I wonder if you really appreciate," he continued earnestly, "how difficult this state of affairs makes my job?"
"It doesn't exactly help mine," replied Karellen with some
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spirit. "I wish people would stop thinking of me as a dictator, and remember I'm only a civil servant trying to administer a colonial policy in whose shaping I had no hand."
That, thought Stormgren, was quite an engaging description. He wondered just how much truth it held.
"Can't you at least give us some reason for your concealment? Because we don't understand it, it annoys us and gives rise to endless rumours."
Karellen gave that rich, deep laugh of his, just too resonant, to be altogether human.
"What am I supposed to be now? Does the robot theory still hold the field? I'd rather be a mass of electron tubes than a thing like a centipede-oh yes, I've seen that cartoon in yesterday's Chicago Times! I'm thinking of requesting the original."
Stormgren pursed his lips primly. There were times, he thought, when Karellen took his duties too lightly.
"This is serious," he said reprovingly.
"My dear Rikki," Karellen retorted, "it's only by not taking the human race seriously that I retain what fragments of my once considerable mental powers I still possess!"
Despite himself Stormgren smiled.
"That doesn't help me a great deal, does it? I have to go down there and convince my fellow men that although you won't show yourself, you've got nothing to hide. It's not an easy job. Curiosity is one of the most dominant of human characteristics. You can't defy it forever."
"Of all the problems that faced us when we came to Earth, this was the most difficult," admitted Karellen. "You have trusted our wisdom in other matters-surely you can trust us in this!"
"I trust you," said Stormgren, "but Wainwright doesn't, nor do his supporters. Can you really blame them if they put a bad interpretation on your unwillingness to show yourselves?"
There was silence for a moment. Then Stormgren heard that faint sound (was it a crackling?) that might have been caused by the Supervisor moving his body slightly.
"You know why Wainwright and his type fear me, don't you?" asked Karellen. His voice was sombre now, like a great organ rolling its notes from a high cathedral nave. "You will find men like him in all the world's religions. They know that we represent reason and science, and however confident they may
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be in their beliefS, they fear that we will overthrow their gods.
Not necessarily through any deliberate act, but in a subtler fashion. Science can destroy religion by ignoring it as well as by disproving its tenets. No-one ever demonstrated, so far as I am aware, the non-existence of Zeus or Thor-but

they have few followers now. The Wainwrights fear, too, that we know the truth about the origins of their faiths. How long, they wonder, have we been observing humanity? Have we watched Mohammed begin the Hegira, or Moses giving the Jews their laws? Do we know all that is false in the stories they believe?"
"And do you?" whispered Stormgren, half to himselL
"That, Rikki, is the fear that torments them, even though they will never admit it openly. Believe me, it gives us no pleasure to destroy men's faiths, but all the world's religions cannot be right-and they know it. Sooner or later man has to learn the truth: but that time is not yet. As for our secrecy, which you are correct in saying aggravates our problems- that is a matter beyond our control. I regret the need for this concealment as much as you do, but the reasons are sufficient. However, I will try and get a statement from my-superiors- which may satisfy you and perhaps placate the Freedom League. Now, please, can we return to the agenda and start recording again?"

"Well?" asked van Ryberg anxiously. "Did you have any luck?"
"I don't know," Stormgren replied wearily as he threw the files down on his desk and collapsed into the seat. "Karellen's consulting his superiors now, whoever or whatever they may be. He won't make any promises."
"Listen," said Pieter abruptly, "I've just thought of something. What reason have we for believing that there is anyone beyond Karellen? Suppose all the Overlords, as we've christened them, are right here on Earth in these ships of theirs?
They may have nowhere else to go, but they're hiding the fact
from us."
"It's an ingenious theory," grinned Stormgren. "But It clashes with what little I know-or think I know-about Karellen's background."
"And how much Is that?"
"Well, he often refers to his position here as something

temporary, hindering him from getting on with his real work, which I think is some form of mathematics. Once I mentioned Acton's quotation about power corrupting, and absolute power corrupting absolutely. I wanted to see how he'd react to that. He gave that cavernous laugh of his, and said: 'There's no danger of that happening to me. In the first case, the sooner I finish my work here, the sooner I can get back to where I belong, a good many light-years from here. And secondly, I don't have absolute power, by any means. I'm just-Supervisor.' Of course, he may have been misleading me. I can never be sure of that."
"He's immortal isn't he?"
"Yes, by our standards, though there's something in the future he seems to fear: I can't imagine what it is. And that's really all I know about him."
"It isn't very conclusive. My theory is that his little fleet's lost in space and is looking for a new home. He doesn't want us to know how few he and his comrades are. Perhaps all those other ships are automatic, and there's no-one in any of them. They're just an imposing façade."
"You," said Stormgren, "have been reading too much science-fiction."
Van Ryberg grinned, a little sheepishly.
"The 'Invasion From Space' didn't turn out quite as expected, did it? My theory would certainly explain why Karellen never shows himself. He doesn't want us to learn that there aren't any more Overlords."
Stormgren shook his head in amused disagreement.
"Your explanation, as usual, is much too ingenious to be true. Though we can only infer its existence, there must be a great civilization behind the Supervisor-and one that's known about man for a very long time. Karellen himself must have been studying us for centuries. Look at his command of English, for example. He taught me how to speak it idiomatically!"

"Have you ever discovered anything he doesn't know?"
"Oh yes, quite often-but only on trivial points. I think he has an absolutely perfect memory, but there are some things he hasn't bothered to learn. For instance, English is the only language he understands completely, though in the last two years he's picked up a good deal of Finnish just to tease me. And one doesn't learn Finnish in a hurry! He can quote great
19
slabs of the 'Kalevala', whereas I'm ashamed to say I know only a few lines. He also knows the biographies of all living statesmen, and sometimes I can identify the references he's used. His knowledge of history and science seems complete-. you know how much we've already learned from him. Yet, taken one at a time, I don't think his mental gifts are quite outside the range ot human achievement. But no man could possibly do all the things he does."
"That's more or less what I've decided already," agreed van Ryberg. "We can argue round Karellen forever, but in the end we always come back to the same question-why the devil won't he show himself? Until he does, I'll go on theorizing and the Freedom League will go on fulminating."
He cocked a rebellious eye at the ceiling.
"One dark night, Mr. Supervisor, I hope some reporter takes a rocket up to your ship and climbs in through the back-door with a camera. What a scoop that would be!" -
If Karellen was listening, be gave no sign. But, of course, he never did.

In the first year of their coming, the advent of the Overlords had made less difference to the pattern of human life than might have been expected. Their shadow was everywhere, but it was an unobtrusive shadow. Though there were few great cities on Earth where men could not see one of the silver ships glittering against the zenith, after a little while they were taken as much for granted as the sun, moon or clouds. Most men were probably only dimly aware that their steadily rising standards of living were due to the Overlords. When they stopped to think of it-which was seldom-they realized that those silent ships had brought peace to all the world for the first time in history, and were duly grateful.
But these were negative and unspectacular benefits, accepted and soon forgotten. The Overlords remained aloof, hiding their faces from mankind. Karellen could command respect and admiration: he could win nothing deeper so long as he pursued his present policy. It was hard not to feel resentment against these Olympians who spoke to man only over the radio-teleprinter circuits at United Nations Headquarters. What took place between Karellen and Stormgren was never publicly revealed, and sometimes Stormgren himself wondered why the Supervisor found these interviews necessary. Perhaps he
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felt the need of direct contact with one human being at least:
perhaps he realized that Stormgren needed this form of personal support If this was the explanation, the Secretary-General appreciated it: he did not mind if the Freedom League referred to him contemptuously as "Karellen's office-boy".
The Overlords had never had any dealings with individual
states and governments: they bad taken the United Nations Organization as they found it, given instructions for installing the necessary radio equipment, and issued their orders through the mouth of the Secretary-General. The Soviet delegate had quite correctly pointed out, at considerable length and upon innumerable occasions, that this was not in accordance with the Charter. Karellen did not seem to worry.
It was amazing that so many abuses, follies and evils could be dispelled by those messages from the sky. With the arrival of the Overlords, nations knew that they need no longer fear each other, and they guessed-even befbre the experiment was made-that their existing weapons were certainly impotent against

a civilization that could bridge the stars. So at once the greatest single obstacle to the happiness of mankind had been removed.

The Overlords seemed largely indifferent to forms of government, provided that they were not oppressive or corrupt. Earth still possessed democracies, monarchies, benevolent dictatorships, communism and capitalism. This was a source
of great surprise to many simple souls who were quite convinced that theirs was the only possible way of life. Others believed that Karellen was merely waiting to introduce a system that would sweep away all existing forms of society, and so had not bothered with minor political reforms. But this, like all other speculations concerning the Overlords, was pure guesswork. No-one knew their motives: and no-one knew towards what future they were shepherding mankind.

3

STORMOREN was sleeping badly these nights, which was strange, since soon he would be putting aside the cares of ofilce forever. He had served mankind for forty years, and its masters for five, and few men could look back upon a life that had seen
21
so manyof its ambitions achieved. Perhaps that was the trouble:
in the years of retirement, however many they might be, he would have no further goals to give any zest to life. Since Martha had died and the children had established their own families, his ties with the world seemed to have weakened. It might be, too, that he was beginning to identify himself with the Overlords, and thus become detached from humanity.

This was another of those restless nights when his brain went on turning like a machine whose governor had failed. He knew better than to woo sleep any further, and reluctantly climbed out of bed. Throwing on his dressing-gown, he strolled out on to the roof garden of his modest flat. There was not one of his direct subordinates who did not possess much more luxurious quarters, but this place was ample for Stormgren's needs. He had reached the position where neither personal possessions nor official ceremony could add anything to his stature. -

The night was warm, almost oppressive, but the sky was clear and a brilliant moon hung low in the south-west. Ten kilometres away, the lights of New York glowed on the skyline like a dawn frozen in the act of breaking.

Stormgren raised his eyes above the sleeping city, climbing again the heights that he alone of living men had scaled. Far away though it was, he could see the hull of Karellen's ship glinting in the moonlight. He wondered what the Supervisor was doing, for he did not believe that the Overlords ever slept.

High above, a meteor thrust its shining spear through the dome of the sky. The luminous trail glowed faintly for a while:
then it died away, leaving only the stars. The reminder was brutal: in a hundred years, Karellen would still be leading mankind towards the goal that he alone could see, but four months from now another man would be Secretary-General. That in itself Stormgren was far from minding-but it meant that little time was left if he ever hoped to learn what lay behind that thickened screen.

Only in the last few days had he dared to admit that the Overlords' secretiveness was beginning to obsess him. Until recently, his faith in Karellen had kept him free from doubts; but now, he thought a little wryly, the protests of the Freedom League were beginning to have their effect upon him. It was true that the propaganda about Man's enslavement was no
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more than propaganda. Few people seriously believed it, or really wished for a return to the old days. Men had grown accustomed to Karellen's imperceptible

rule-but they were becoming impatient to know who ruled them. And how could they be blamed?
Though it was much the largest, the Freedom League was only one of the organizations that opposed Karellen-and, consequently, the humans who co-operated with the Overlords. The objçctions and policies of these groups varied enormously:
some took the religious viewpoint, while others were merely expressing a sense of inferiority. They felt, with good reason, much as a cultured Indian of the nineteenth century must have done as he contemplated the British Raj. The invaders had brought peace and prosperity to Earth-but who knew what the cost might be? History was not reassuring: even the most peaceable of contacts between races at very different cultural levels had often resulted in the obliteration of the more backward society. Nations, as well as individuals, could lose their spirit when confronted by a challenge which they could not meet. And the civilization of the Overlords, veiled in mystery though it might be, was the greatest challenge Man had ever faced.
There was a faint click from the facsimile machine in the adjoining room as it ejected the hourly, summary sent out by Central News. Stormgren wandered indoors and ruffled halfheartedly through the sheets. On the other side of the world, the Freedom League had inspired a not-very-original headline.
"IS MAN RULED BY MONSTERS?" asked the paper, and went on to quote: "Addressing a meeting in Madras today, Dr. C. V.
Krishnan, President of the Eastern Division of the Freedom League, said: 'The explanation of the Overlords' behaviour Is quiet simple: Their physical form is so alien and repulsive that they dare not show themselves to humanity. I challenge the Supervisor to deny this."
Stormgren threw down the sheet in disgust. Even if the charge were true, did it really matter? The idea was an old one, but it had never worried him. He did not believe that there was my biological form, however strange, which he could not accept Lii time and, perhaps, even find beautiful. The mind, not the body, was all that mattered. If only he could convince Karellen of this, the Overlords might change their policy. It was certain that they could not be half as hideous as the

imaginative drawings that had filled the papers soon after their coming to Earth!
Yet it was not, Stormgren knew, entirely consideration for his successor that made him anxious to see the end of this state of affairs. He was honest enough to admit that, in the final analysis, his, main motive was simple human curiosity. He bad grown to know Karellen as a person, and he would never be satisfied until he had also discovered what kind of creature he might be.

When Stormgren fIiiled to arrive at his usual time next morning, Pieter van Ryberg was surprised and a little annoyed. Though the Secretary General often made a number of calls before reaching his own office, he invariably left word that he was doing so. This morning, to make matters worse, there had been several urgent messages for Stormgren. Van Ryberg rang haIfa dozen departments to try and locate him, then gave it up in disgust.
By noon he had become alarmed and sent a car to Stormgren's house. Ten minutes later he was startled by the scream of a siren, and a police patrol came racing up Roosevelt Drive. The news agencies must have had friends in that vehicle, for even as van Ryberg watched it approach, the radio was telling the world that he was no longer merely Assistant-but Acting-Secretary-General of the United Nations.

Had van Ryberg fewer troubles on his hands, he would have found it entertaining to study the Press reactions to Stormgren's disappearance. For the past month, the world's papers had divided themselves into two sharply defined groups. The Western press, on the whole, approved of Kar~llen's plan to 'make all men citizens of the world. The Eastern countries, on the other hand, were undergoing violent but largely synthetic spasms of national pride. Some of them had been independent for little more than a generation, and felt that they bad been cheated out of their gains. Criticism of the Overlords was widespread and energetic: after an initial period of extreme caution, the Press had quickly found that it could be as rude to Karellen as it liked and nothing would happen. Now it was excelling itself.

Most of these attacks, though very vocal, were not representative of the great mass of the people. Along the frontiers that would soon be gone forever the guards had been doubled

-but the soldiers eyed each other with a still inarticulate friendliness. The politicians and the generals might storm and rave, but the silently waiting millions felt that, none too soon, a long and bloody chapter of history was coming to an end.

And now Stormgren had gone, no-one knew where. The tumult suddenly subsided as the world realized that it had lost the only man through whom the Overlords, for their own strange reasons, would speak to Earth. A paralysis seemed to descend upon the press and radio commentators: but in the silence could be heard the voice of the Freedom League, anxiously protesting its innocence.

It was utterly dark when Stormgren awoke. For a moment he was too sleepy to realize how strange that was. Then, as full consciousness dawned, he sat up with a start and felt for the switch beside his bed.

In the darkness his hand encountered a bare stone wall, cold to the touch. He froze instantly, mind and body paralysed by the impact of the unexpected. Then, scarcely believing his senses, he kneeled on the bed and began to explore with his finger-tips that shockingly unfamiliar wall.

He had been doing this only for a moment when there was a sudden click and a section of the darkness slid aside. He caught a glimpse of a man silhouetted against a dimly lit background: then the door closed again and the darkness returned. It happened so swiftly that he had no chance to see anything of the room in which he was lying.

An instant later, he was dazzled by the light of a powerful electric torch. The beam ffickered across his face, held him steadily for a moment, then dipped to illuminate the whole bed

-which was, he now saw, nothing more than a mattress supported on rough planks. Out of the darkness a soft voice spoke to him in excellent English, but with an accent which Stormgren could not at first identif~~.

"Au, Mr. Secretary-I'm glad to see you're awake. I hope you feel quite all right."

There was something about the last sentence that caught

Stormgren's attention, so that the angry questions he had been about to ask died upon his lips. He stared back into the darkness, then replied calmly: "How long have I been UflCOfl scious?"

The other chuckled.

"Several days. We were promised there'd be no after-effects. I'm glad to see it's true."

Partly to gain time, partly to test his own reactions, Stormgren swung his legs over the side of the bed. He was sqil wearing his night-clothes, but they were badly crumpled and seemed to have gathered considerable dirt. As he moved he

felt a slight dizziness-not enough to be unpleasant but sufficient to convince him that he had indeed been drugged.
He turned towards the light.
"Where am I?" he said sharply. "Does Wainwright know about this?"
"Now, don't get excited," replied the shadowy figure. "We won't talk about that sort of thing yet. I guess you're pretty hungry. Get dressed and come along to dinner."
The oval of light slipped across the room and for the first time Stormgren had an idea of its dimensions. It was scarcely a room at all, for the walls seemed bare rock, roughly smoothed into shape. He realized that he was underground, possibly at a great depth. And if he had been unconscious for several days, he might be anywhere on Earth.
The torch-light illuminated a pile of clothes draped over a packing-case.
"This should be enough for you," said the voice from the darkness. "Laundry's rather a problem here, so we grabbed a couple of your suits and half a dozen shirts."
"That," said Stormgren without humour, "was very considerate of you."
"We're sorry about the absence of furniture and electric Light. This place is convenient in some ways, but it rather lacks amenities."
"Convenient for what?" asked Stormgren as he climbed into a shirt. The feel of the familiar cloth beneath his fingers was strangely reassuring.
"Just-convenient," said the voice. "And by the way, since we're likely to spend a good deal of time together, you'd better call me Joe.
"Despite your nationality," retorted Stormgren, "you're

E'olish, aren't you?-I think I could pronounce your real name.
Et won't be worse than many Finnish ones."
There was a slight pause and the light flickered for an distant.
'Well, I should have expected it," said Joe resignedly.
"You must have plenty of practice at this sort of thing."
"It's a useful hobby for a man in my position. At a guess I ihould say you were brought up in the United States but didn't ~eave Poland Until-"
"That," said Joe firmly, "is quite enough. As you seem to save finished dressing-thank you."
The door opened as Stormgren walked towards it, feeling nildly elated by his small victory. As Joe stood aside to let aim pass, he wondered if his captor was armed. Almost cer~ainly he would be, and in any case he would have friends around.
The corridor was dimly lit by oil lamps at intervals, and for the first time Stormgren could see Joe clearly. He was a man Df about fifty, and must have weighed well over two hundred pounds. Everything about him was outsize, from the stained battledress that might have come from any of half a dozen armed forces, to the startlingly large signet ring on his left band. A man built on this scale probably would not bother to carry a gun. It should not be difficult to trace him, thought Stormgren, if he ever got out of this place. He was a little de-. pressed to realize that Joe must also be perfectly well aware of this fact.
The walls around them, though occasionally faced with concrete, were mostly bare rock. It was dear to Stormgren that he was in some disused mine, and he could think of few more effective prisons. Until now the fact of his kidnapping had failed to worry him greatly. He had felt that, whatever happened, the immense resources of the Overlords would soon locate and rescue him. Now he was not so sure. He had already been gone several days-and nothing had happened. There must be a limit even to Karellen's power, and if he were indeed buried in some remote continent, all the science of the Overlords might be unable to trace him.
There were two other men sitting at the table in the bare, dimly lit room. They looked up with interCst, and more than a little respect, as Stormgren entered. One of them pushed across a bundle of sandwiches which Stormgren accepted

eagerly. Though he felt extremely hungry, he could have done with a more interesting meal, but it was probable that his captors had dined no better.
As he ate, he glanced quickly at the three men around him.
~oe was by far the most outstanding character, and not merely In the matter of physical bulk. The others were clearly his assistants-nondescript individuals, whose origins Stormgren would be able to place when he heard them talk.
Some wine had been produced in a not-too-aseptic glass,
and Stormgren washed down the last of the sandwiches.
Feeling now more fully in command of the situation, he turned to the huge Pole.
'Well," he said evenly, "perhaps you'll tell me what all this Is about, and just what you hope to get out of it."
Joe cleared his throat.
"I'd like to make one thing straight," he said. "This is nothing to do with Wainwright. He'll be as surprised as anyone.',
Stormgren had half expected this, though he wondered why Joe was confirming his suspicions. He had long suspected the existence of an extremist movement inside- or on the frontiers of-the Freedom League.
"As a matter of interest," he said, "how did you kidnap me?"
He hardly expected a reply to this, and was somewhat taken aback by the other's readiness-even eagerness-to answer.
"It was all rather like a Hollywood thriller," said Joe cheerfully. "We weren't sure if Karellen kept a watch on you, so we took somewhat elaborate precautions. You were knocked out by gas in the air-conditioner--that was easy. Then we carried you out into the car-no trouble at all. All this, I might say, wasn't done by any of our people. We hired-er-professionals fur the job. Karellen may get them-in fact, he's supposed to
-but he'll be no wiser. When it left your house, the car drove into a long road tunnel not a thousand kilometres from New York. It came out again on schedule at the opposite end, still carrying a drugged man extraordinarily like the Secretary-General. Quite a while later a large truck loaded with metal cases emerged in the opposite direction and drove to a certain airfield where the cases were loaded aboard a freighter on perfectly legitimate business. I'm sure the owners of those cases would be horrified to know how we employed them.
"Meanwhile the car that had actually done the job continued

elaborate evasive action towards the Canadian border. Perhaps Karellen's caught it by now: I don't know or care. As you'll iee-I do hope you appreciate my frankness-our whole plan depended on one thing. We're pretty sure that Karellen can ee and hear everything that happens on the surface of the Earth-but unless he uses magic, not science, he can't see mderneath it. So he won't know about the transfer in the tunnel-at least until it's too late. Naturally we've taken a risk, but there were also oneor two other safeguards I won't go into aow. We may want to use them again, and it would be a pity to give them away."
Joe had related the whole story with such obvious gusto that Stormgren could hardly help smiling. Yet he also felt very iisturbed. The plan was an ingenious one, and it was quite possible that Karellen had been deceived. Stormgren was not even certain that the Overlord kept any form of protective rnrveillance over him. Nor, clearly, was Joe. Perhaps that was why he had been so frank-he wanted to test Stormgren's reactions. Well, he would try and appear confident, whatever his real feelings might be.
"You must be a lot of fools," said Stormgren scornfully, "if you think you can trick the Overlords as easily as this. In any case, what conceivable good will it do?"
Joe offered him a cigarette, which Stormgren refused, then [it one himself and sat on the edge of the table. There was an ominous creaking and he jumped off hastily.

"Our motives," he began, "should be pretty obvious. We've found arguments useless, so we have to take other measures. There have been underground movements before, and even Karellen, whatever powers he's got, won't find it easy to deal with us. We're out to fight for our independence.
Don't misunderstand me. There'll be nothing violent-at [hat, anyway-but the Overlords have to use human agents, and we can make it mighty uncomfortable for them."
Starting with me, I suppose, thought Stormgren. He wondered if the other had given him more than a fraction of the whole story. Did they really think that these gangster methods would Influence Karellen in the slightest? On the ther hand, it was quite true that a well-organized resistance movement could make life very difficult. For Joe had put his [luger on the one weak spot in the Overlords' rule. Ultimately, all their orders were carried out by human agents. If these were
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terrorized into disobedience, the whole system might collapse. It was only a faint possibility, for Stormgren felt confident that Karellen would soon find some solution.
"What do you intend to do with me?" asked Stormgren at length. "Am I a hostage, or what?"
"Don't worry-we'll look after you. We expect some visitors in a few days, and until then we'll entertain you as well as we
can."
He added some words in his own language, and one of the others produced a brand-new pack of cards.
"We got these especially fur you," explained Joe. "I read in Time the other day that you were a good poker player." His voice suddenly became grave. "I hope there's plenty of cash in your wallet," he said anxiously. 'We never thought of looking. After all, we can hardly accept cheques."
Quite overcome, Stormgren stared blankly at his captors.
Then, as the true humour of the situation sank into his mind, it suddenly seemed to him that all the cares and worries of office had lifted from his shoulders. From now on, it was van Ryberg's show. Whatever happened, there was absolutely nothing he could do about it-and now these fantastic criminals were anxiously waiting to play poker with him.
Abruptly, he threw back his head and laughed as he had not done for years.

There was no doubt, thought van Ryberg morosely, that Wainwright was telling the truth. He might have his suspicions, but he did not know who had~kidnapped Stormgren. Nor did he approve of the kidnapping itself: Van Ryberg had a shrewd idea that for some tune extremists in the Freedom League had been putting pressure on Wainwright to make him adopt a more active policy. Now they were taking matters into their own hands.
The kidnapping had been beautifully organized, there was no doubt of that. Stormgren might be anywhere on Earth, and there seemed little hope of tracing him. Yet something must be done, decided van Ryberg, and done quickly. Despite the jest. he had so often made, his real feeling towards Karellen was one of overwhelming awe. The thought of approaching the Supervisor directly filled him with dismay, but there seemed no alternative.
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The Communications Section occupied the entire top floor
of the great building. Lines of facsimile machines, some silent, some clicking busily, stretched away into the distance. Through them poured endless streams of statistics-production figures, census returns, and all the book-keeping of a world economic system. Somewhere up in Karellen's ship must lie the equivalent of this great room-and van Ryberg wondered, with a tingling of the spine, what

shapes moved to and fro collecting the messages that Earth was sending to the Overlords.

But today he was not interested in these machines and the routine business they handled. He walked to the little private room that only Stormgren was supposed to enter. At his instructions, the lock had been forced and the Chief Communications Officer was waiting there for him.

"It's an ordinary teleprinter-standard typewriter keyboard," he was told. "There's a facsimile machine as well if you want to send any pictures or tabular information-but you said you wouldn't be needing that."

Van Ryberg nodded absently. "l'hat's all. Thanks," he said. "I don't expect to be here very long. Then get the place locked up again and give me all the keys."

He waited until the Communications Officer had left, and then sat down at the machine. It was, he knew, very seldom used, since nearly all business between Karellen and Stormgren was dealt with at their weekly meetings. Since this was something of an emergency circuit, he expected a reply fairly quickly.

After a moment's hesitation, he began to tap out his message with unpractised fingers. The machine purred away quietly and the words gleamed for a few seconds on the darkened screen.

Then he leaned back and waited for the answer.

Scarcely a minute later the machine started to whirr again. Not for the first time, van Ryberg wondered if the Supervisor ever slept.

The message was as brief as it was unhelpful.

NO INFORMATION. LEAVE MATTERS ENTIRELY TO YOUR DISCRETION. K.

Rather bitterly, and without any satisfaction at all, van Ryberg realized how much greatness had been thrust upon him

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During the past three days Stormgren had analysed his captors with some thoroughness. Joe was the only one of any Importance: the others were nonentities-the riff-raff one would expect any illegal movement to gather round itself The ideals of the Freedom League meant nothing to them: their only concern was earning a living with the minimum of work.

Joe was an altogether more complex individual, though sometimes he reminded Stormgren of an overgrown baby. Their interminable poker games were punctuated with violent political arguments, and it soon became obvious to Stormgren that the big Pole had never thought seriously about the causes for which he was fighting. Emotion and extreme conservatism clouded all his judgments. His country's long struggle for Independence had conditioned him so completely that ~ie still lived in the past. He was a picturesque survival, one of those who had no use for an ordered way of life. When his type vanished, if it ever did, the world would be a safer but lessInteresting place.

There was now little doubt, as far as Storingren was concerned, that Karellen had failed to locate him. He had tried to blufl, but his captors were unconvinced. He was fairly certain that they had been holding him here to see if Karellen would act, and now That nothing had happened they could proceed with their plans.

Stormgren was not surprised when, four days after his capture, Joe told him to expect visitors. For some time the little group had shown increasing nervousness, and the prisoner guessed that the leaders of the movement, having seen that the coast was dear, were at last coming to collect him.

They were already waiting, gathered round the rickety table, when Joe waved him politely into the living room. Stormgren was amused to note that his jailer was now wearing, very ostentatiously, a huge pistol that had never been in evidence before. The two thugs had vanished, and even Joe seemed somewhat restrained.

Stormgren could see at once that he was now confronted by men of a much higher calibre, and the group opposite him reminded him strongly of a picture he had once seen of Lenin and his associates in the first da~ys of the Russian Revolution. There was the same intellectual force, iron determination, and

ruthlessness in these six men. Joe and his kind were harmless: here were the real brains behind the organization.

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With a curt nod, Stormgren moved over to the only vacant seat and tried to look self-possessed. As he approached, the elderly, thick-set man on the far side of the table leaned forward and stared at him with piercing grey eyes. They made Stormgren so uncomfortable that he spoke first-something he had not intended to do.

"I suppose you've come to discuss terms. What's my ransom?"

He noticed that in the background someone was taking down his words in a shorthand notebook. It was all very businesslike.

The leader replied in a musical Welsh accent.

"You could put it that way, Mr. Secretary-Genera]. But we're interested in information, not cash."

So that was it, thought Stormgren. He was a prisoner of war, and this was his interrogation.

"You know what our motives are," continued the other in his softly lilting voice. "Call us a resistance movement, if you like. We believe that sooner or later Earth will have to fight for its independence-but we realize that the struggle can only be by indirect methods such as sabotage and disobedience. We kidnapped you partly to show Karellen that we mean business and are well organized, but largely because you are the only man who can tell us anything of the Overlords. You're a reasonable man, Mr. Stormgren. Give us your co-operation, and you can have your freedom."

"Exactly what do you wish to know?" asked Stormgren cautiously.

Those extraordinary eyes seemed to search his mind to its depths: they were unlike any that Stormgren had ever seen in his life. Then the sing-song voice replied:

"Do you know who, or what, the Overlords really are?"

Stormgren almost smiled.

"Believe me," he said, "I'm quite as anxious as you to discover that."

"Then you'll answer our questions?"

"I make no promises. But I may."

There was a slight sigh of relief from Joe, and a rustle of anticipation ran round the room.

"We have a general idea," continued the other, "of the circumstances in which you meet Karellen. But perhaps you

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would describe them carefully, leaving out nothing of importance."

That was harmless enough, thought Storingren. He had done it many times before, and it would give the appearance of co-operation. There were acute minds here, and perhaps they could uncover something new. They were welcome to any fresh information they could extract from him-so long as they shared it. That it could harm Karellen in any way he did not fur a moment believe.

Stormgren felt in his pockets and produced a pencil and an old envelope. Sketching rapidly while he spoke, he began:

"You know, of course, that a small flying machine, with no obvious means of propulsion, calls for me at regular intervals and takes me up to Karellen's ship. It enters the hull-and you've doubtless seen the telescopic films that have been taken of that operation. The door opens again-if you can call it a door-and I go into a small room with a table, a chair, and a vision screen. The layout is something like this."

He pushed the plan across to the old Welshrnan, but the strange eyes never turned towards it. They were still fixed on Stormgren's face, and as he watched them something seemed to change in their depths. The room had become completely silent, but behind him he heard Joe take a sudden indrawn breath.

Puzzled and annoyed, Stormgren stared back at the other, and as he did so, understanding slowly dawned. In his confusion he crumpled the envelope into a ball of paper and ground it underfoot.
He knew now why those grey eyes had affected him so strangely. The man opposite him was blind.

Van Ryberg had made no further attempts to contact. Karellen. Much of his department's work-the forwarding of statistical information, the abstracting of the world's press, and the like-had continued automatically. In Paris the lawyers were still wrangling over the proposed World Constitution, but that was none of his business for the moment. It was a fortnight before the Supervisor wanted the final draft: if it was not ready by then, no doubt Karellen would take what action he thought fit.
And there was still no news of Stormgren.

4

Van Ryberg was dictating when the "Emergency Only"
telephone started to ring. He grabbed the receiver and listened with mounting astonishment, then threw it down and rushed to the open window. In the distance, cries of anlazement were rising from the streets, and traffic was slowing to a halt.
It was true: Karellen's ship, that never-changing symbol of the Overlords, was no longer in the sky. He searched the heavens as far as he could see, and found no trace of it. Then, suddenly, it seemed as if night had swiftly fallen. Coming down from the north, its shadowed underbelly black as a thundercloud, the great ship was racing low over the towers of New York. Involuntarily, van Ryberg shrank away from the onrushing monster. He had always known how huge the ship. of the Overlords really were-but it was one thing to see them far away in space, and quite another to watch them passing overhead like demon-driven clouds.
In the darkness of that partial eclipse, he watched until the ship and its monstrous shadow had vanished into the south. There was no sound, not even the whisper of air, and van Ryberg realized that despite its apparent nearness the ship had passed at least a kilometre above his head. Then the building shuddered once as the shock wave struck it, and from somewhere came the tinkling of broken glass as a window blew inwards.
In the office behind him all the telephones had started to ring, but van Ryberg did not move. He remained leaning against the window ledge, still staring into the south, paralysed by the presence of illimitable power.

As Stormgren talked, it seemed to him that his mind was operating on two levels simultaneously. On the one hand he was trying to defy the men who had captured him, yet on the other he was hoping that they might help him unravel Karellen's secret. It was a dangerous game, yet to his surprise he was enjoying it.
The blind Weishman had conducted most of the interrogation. It was fascinating to watch that agile mind trying one opening after another, testing and rejecting all the theories that Stormgren himself had abandoned long ago. Presently he leaned back with a sigh.
"We're getting nowhere," he said resignedly. "We want

more facts, and that means action, not argument." The sightless eyes seemed to stare thoughtfully at Stormgren. For a moment he tapped nervously on the table-it was the first sign of uncertainty that Stormgren had noticed. Then he continued:
"I'm a little surprised, Mr. Secretary, that you've never made any effort to learn more about the Overlords."

"What do you suggest?" asked Stormgren coldly, trying to disguise his interest.
"I've told you that there's only one way out of the room in which I have my talks with Karellen-and that leads straight back to Earth."
"It might be possible," mused the other, "to devise instruments which could teach us something. I'm no scientist, but we can look into the matter. If we give you your freedom, would you be willing to assist with such a plan?"
"Once and fur all," said Stormgren angrily, "let me make my position perfectly clear. Karellen is working for a united world, and I'll do nothing to help his enemies. What his ultimate plans may be, I don't know, but I believe that they are good."
'What real proof have we of that?"
"All his actions, ever since his ships appeared in our skies. I defy you to mention one act that, in the ultimate analysis, hasn't been beneficial."
Stormgren paused for a moment, letting his mind run back thrpugh the past years. Then he smiled.
"If you want a single proof of the essential-how shall I put it?-benevolence of the Overlords, think of that cruelty-to-animals order which they made within a month of their arrival.
If I had any doubts about Karellen before, that banished them
-even though that order baa caused me more trouble than anything else he's ever done!"
That was scarcely an exaggeration, Stormgren thought. The whole incident had been an extraordinary one, the first revelation of the Overlords' hatred of cruelty. That, and their passion for justice and order, seemed to be the dominant emotions in their lives-as far as one could judge them by their actions.
And it was the only time Karellen bad shown anger, or at least the appearance of anger. "You may kill one another if you wish," the message had gone, "and that is a matter between you and your own laws. But if you slay, except for food or in self-defence, the beasts that share your world with you-then you may be answerable to me."
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No one knew exactly how comprehensive this ban was supposed to be, or what Karellen would do to enforce it. They had not long to wait.
The Plaza de Toros was full when the matadors and their attendants began their professional entry. Everything seemed normal: the brilliant sunlight blazed harshly on the traditional costumes, the great crowd greeted its favourites as it had a hundred times before. Yet here and there faces were turned anxiously towards the sky, to the aloof silver shape fifty kilo-metres above Madrid.
Then the picadors bad taken up their places and the bull had come snorting out into the arena. The skinny horses, nostrils wide with terror, had wheeled in the sunlight as their riders forced them to meet their enemy. The first lance flashed-made contact-and at that moment came a sound that had never been heard on Earth befbre.
It was the sound often thousand people screaming with the pain of the same wound-ten thousand people who, when they bad recovered from the shock, found themselves completely unharmed. But that was the end of that bull-fight, and indeed of all bull-fighting, for the news spread rapidly. It is worth recording that the aficionados were so shaken that only one in ten asked for their money back, and also that the London Daily Mirror made matters much worse by suggesting that the Spaniards adopt cricket as a new national sport.
"You may be correct," the old Weishman replied. 'Possibly the motives of the Overlords are good-according to their standards, which may sometimes be the same as ours. But they are interlopers-we never asked them to come here and turn our world upside-down, destroying ideals-yes, and nations-that generations of men have fought to protect."

"I come from a small nation that had to fight for its liber.ties," retorted Stormgren. "Yet I am for Kareilen. You may annoy him, you may even delay the achievement of his aims, but it will make no difference m the end. Doubtless you are sincere in believing as you do: I can understand your fear that the traditions and cultures of little countries will be overwhelmed when the World State arrives. But you are wrong:
it is useless to cling to the past. Even before the Overlords came to Earth, the sovereign state was dying. They have merely hastened its end: no one can save it now-and no one should try."
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There was no answer: the man opppsite neither moved nor spoke. He sat with his lips half open, his eyes now lifeless as well as blind. Around hint the others were equally motionless, frozen in strained, unnatural attitudes. With a gasp of pure horror, Stormgren rose to his feet and backed away towards the door. As he did so the silence was suddenly broken.
"That was a nice speech, Rikki: thank you. Now I think we can go."
Stormgren spun on his heels and stared into the shadowed corridor. Floating there at eye-level was a small, featureless sphere-the source, no doubt, of whatever mysterious force the Overlords had brought into action. It was hard to be sure, but Stormgren imagined that be could hear a faint humming, as of a hive of bees on a drowsy summer day.
"Karellen! Thank God! But what have you done?"
"Don't worryj they're quite all right. You can call it a paralysis, but it's much subtler than that. They're simply living a few thousand years more slowly than normal. When we've gone they'll never know what happened."
"You'll leave them here until the police come?"
"No. I've a much better plan. I'm letting them go."
Stormgren felt a surprising sense of relief. He gave a last valedictory glance at the little room and its frozen occupants. Joe was standing on one foot, staring very stupidly at nothing. Suddenly Stormgren laughed and fumbled in his pockets.
"Thanks for the hospitality, Joe," he said. "I think I'll leave a souvenir."
He ruffled through the scraps of paper until he had found the figures he wanted. Then, on a reasonably clean sheet, he wrote carefully:

B~u~ OF MANHATTAN
Pay Joe the sum of One hundred Thirty-Five Dollars and Fifty Cents ($135.50)
R. Stormgren.

As he laid the strip of paper beside the Pole, Karellen's voice enquired:
"Exactly what are you doing ?"
"We Stormgrens always pay our debts. The other two cheated, but Joe played fair. At least I never caught him out."
He felt very gay and lightheaded, and quite forty years younger, as he walked to the door. The metal sphere moved
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4
aside to let him pass. He assumed that it was some kind of robot, and it explained how Karellen had been able to reach him through the unknown layers of rock overhead.
"Carry straight on for a hundred metres," said the sphere, speaking in Karellen's voice. "Then turn to the left until I give you further instructions."
He strode forward eagerly, though he realized that there was no need for hurry. The sphere remained hanging in the corridor, presumably covering his retreat. A minute later he came across a second sphere, waiting for him at a branch in the corridor.

"You've half a kilometre to go," it said. "Keep to the left until we meet again."
Six times he encountered the spheres on his way to the open. At first he wondered if, somehow, the robot was managing to keep ahead of him; then he guessed that there must be a chain of the machines maintaining a complete circuit down into the depths of the mine. At the entrance a group of guards formed a piece of improbable statuary, watched over by yet another of the ubiquitous spheres. On the hillside a few metres away lay the little flying machine in which Stormgren had made all his journeys toKarellen.
He stood for a moment blinking in the sunlight. Then he saw the ruined mining machinery around hint, and beyond that a derelict railway stretching down the mountainside. Several kilometres away a dense forest lapped at the base of the mountain, and very far off Stormgren could see the gleam of water from a great lake. He guessed that he was somewhere in South America, though it was not easy to say exactly what gave him that impression.
As he climbed into the little flying machine, Stormgren had a last glimpse of the mine entrance and the men frozen around
it. Then the door sealed behind him and with a sigh of relief
he sank back upon the familiar couch.
For a while he waited until he had recovered his breath; then he uttered a single, heart-felt syllable:
"Well?"
"I'm sorry I couldn't rescue you before. But you see how very important it was to wait until all the leaders bad gathered here."
"Do you mean to say," spluttered Stormgren, "that you knew where I was all the time? If I thought-"

"Don't be too hasty," answered Karellen, "at least, let me 6nish exp1~iining."
"Very well," said Stormgren darkly, "I'm listening." He was beginning to suspect that he had been no more than bait In an elaborate trap.
"I've had a-perhaps 'tracer' is the best word for it-on you For some time," began Karellen. "Though your late friends were correct in thinking that I couldn't follow you underground, I was able to keep track until they brought you to the nine. That transfer in the tunnel was ingenious, but when the first car ceased to react it gave the plan away and I soon located you again. Then it was merely a matter of waiting. I knew that once they were certain I'd lost you, the leaders would come here and I'd be able to~p them all."
"But you're letting them go!"
"Until now," said Karellen, "I had no way of telling who of the two and a half billion men on this planet were the real heads of the organization. Now that they're located, I can trace their movements anywhere on Earth, and can watch their actions in detail if I want to. That's far better than locking them up. If they make any moves, they'll betray their remaining comrades.
They're effectively neutralized, and they know it. Your rescue will be completely inexplicable to them, for you must have vanished before their eyes."
That rich laugh echoed round the tiny room.
"In some ways the whole affair was a comedy, but it had a serious purpose. I'm not merely concerned with the few score men in this organization-I have to think of the moral effect on other groups that exist elsewhere."
Stormgren was silent for a while. He was not altogether satisfied, but he could see Karellen's point of view, and some of his anger had evaporated.
"It's a pity to do it in my last few weeks of office," he said finally, "but from now on I'm going to have a guard on my house. Pieter can be kidnapped next time. How has he managed, by the way?"
"I've watched him carefWly this last week, and have deliberately avoided helping him. On the whole he's done very well- but he's not the man to take your place."

"That's lucky for him," said Stormgren, still somewhat aggrieved. "And by the way, have you had any word yet from your superiors-about showing yourself to us? I'm sure now
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that it's the strongest argument your enemies have. Again and again they told me: 'We'll never trust the Overlords until we can see them.'"
Kardilen sighed.
"No. I've heard nothing. But I know what the answer must be."
Stormgren did not press the matter. Once he might have done so, but now for the first time the faint shadow of a plan was beginning to take shape in his mind. The words of his interrogator passed again through his memory. Yes, perhaps instruments could be devised....
What he had refused to do under duress, he might yet attempt of his own free wilL

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IT would never have occurred to Stormgren, even a few days before, that he could seriously have considered the action he was plnnning now. This ridiculously melodramatic kidnapping, which in retrospect seemed like a third-rate TV drama, probably had a great deal to do with his new outlook. It was the first time in his life that Stormgren had ever been exposed to violent physical action, as opposed to the verbal battles of the conference room. The virus must have entered his bloodstream: or else he was merely approaching second childhood more quickly than he had supposed.
Sheer curiosity was also a powerful motive, and so was a determination to get his own back for the trick that had been played upon him. It was perfectly obvious now that Karellen had used him as a bait, and even if this had been for the best of reasons, Stormgren did not feel inclined to forgive the Supervisor at once.
Pierre Duval showed no surprise when Stormgren walked unannounced into his office. They were old friends and there was nothing unusual in the Secretary-General paying a personal visit to the Chief of the Science Bureau. Certainly Karellen would not think it odd, if by any chance he-or one of his underlings-turned his instruments of surveillance upon this spot.
For a while the two men talked business and exchanged
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political gossip; then, rather hesitantly, Stormgren came to the point. As his visitor talked, the old Frenchman leaned back in his chair and his eyebrows rose steadily, millimetre by millimetre, until they were almost entangled in his forelock. Once or twice he seemed about to speak, but each time thought better of it.
When Stormgren had finished, the scientist looked nervously around the room.
"Do you think he's listening?" he said.
"I don't believe he can. He's got what he calls a tracer on me, for my protection. But it doesn't work underground, which is one reason why I came down to this dungeon of yours. It's supposed to be shielded from all forms of radiation, isn't it? Karellen's no magician. He knows where I am, but that's all."
"I hope you're right. Apart from that, won't there be trouble when he discovers what you're trying to do? Because he will, you know."
"I'll take that risk. Besides, we understand each other rather well."
The physicist toyed with his pencil and stared into space for a while.

"It's a very pretty problem. I like it," he said simply. Then he dived into a drawer and produced an enormous writing-pad, quite the biggest that Stormgren had ever seen.
"Right," he began, scribbling furiously in what seemed to be some private shorthand. "Let me make sure I have all the facts. Tell me everything you can about the room in which you have your interviews. Don't omit any derail, however trivial it seems."
"There isn't much to describe. It's made of metal, and is about eight metres square and four high. The vision screen is about a metre on a side and there's a desk immediately beneath it-here, it will be quicker if I draw it for you."
Rapidly Stormgren sketched the little room he knew so well, and pushed the drawing over to DuvaL As he did so, he recalled, with a slight shiver, the last time he had done this sort of thing. He wondered what had happened to the blind Welsh-man and his confederates, and how they had reacted to his abrupt departure.
The Frenchman studied the drawing with a puckered brow.
"And that's all you can tell me?"
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Duval snorted in disgust.
"What about lighting? Do you sit in total darkness? And how about ventilation, heating. . .
Stormgren smiled at the characteristic outburst.
"The whole ceiling is luminous, and as far as I can tell the air comes through the speaker grille. I don't know how it leaves; perhaps the stream reverses at intervals, but I haven't noticed it. There's no sign of any heater, but the room is always at normal temperature."
"Meaning, I suppose, that the water vapour has frozen out, but not the carbon dioxide."
Stormgren did his best to smile at the well-worn joke.
"I think I've told you everything," he concluded. "As for the machine that takes me up to Kardllen's ship, the room in which I travel is as featureless as an elevator cage. Apart from he couch and table, it might very well be one."
There was silence for several minutes while the physicist embroidered his writing-pad with meticulous and microscopic doodles. As he watched, Stormgren wondered why it was that a man like Duval-whose mind was incomparably more brilliant than his own-had never made a greater mark in the world of science. He remembered an unkind and probably inaccurate comment of a friend in the U.S. State Department. "The French produce the best second-raters in the world." Duval was the sort of man who supported that statement.
The physicist nodded to himself in satisfaction, leaned forward and pointed his pencil at Stormgren.
"What makes you think, Rikki," he asked, "that Karellen's vision-screen, as you call it, really is what it pretends to be?"
"I've always taken it for granted: it looks exactly like one. What else would it be, anyway?"
"When you say that it looks like a vision-screen, you mean, don't you, that it looks like one of ours?"
"Of course."
"I find that suspicious in itself. I'm sure the Overlord's own apparatus won't use anything so crude as an actual physical screen-they'll probably materialize images directly in space. But why should Karellen bother to use a TV system, anyway?
The simplest solution is always best. Doesn't it seem far more probable that your 'vision-screen' is really ?wtluizg mon cornplico4ed than a sheet of one-way glass?"
43
Stormgren was so annoyed with himself that for a moment

h~ sat in silence, retracing the past. From the beginning, he j~id never challenged Rardllen's story-yet now he came to look back, when had th~ Supervisor ever told him that he was using a TV system? He had simply taken it for granted: the whole thing had been a piece of psychological trickery, and he had been completely deceived. Always assuming, of course, that Duval's theory was correct. But he was jumping to conclusions again: no one had proved anything yet.

"If you're right," he said, "all I have to do is to smash the glass-"

Duval sighed.

"These unscientific laymen! Do you think it'll be made of anything you could smash without explosives? And if you succeeded, do you im~agine that Karellen is likely to breathe the same air that we do? Won't it be nice for both of you if he flourishes in an atmosphere of chlorine?"

Storrogren felt a little foolish. He should have thought of that.

"Well, what do you suggest?" he asked with some exasperation.

"I want to think it over. First of all we've got to find if my theory is correct, and if so learn something about the material of that screen. I'll put a couple of my men on the job. By the way, I suppose you carry a brief-case when you visit the Supervisor? Is it the one you've got there?"

"Yes."

"It should be big enough. We don't want to attract attention by changing it for another, particularly if Karellen's grown used to it."

'What do you want me to do?" asked Stormgren. "Carry a concealed X-ray set?"

The physicist grinned.

"I don't know yet, but we'll think of something. I'll let you know what it is in a fortnight's time."

He gave a little laugh.

"Do you know what all this reminds me of?"

"Yes," said Stormgren promptly, "the time you were building illegal radio sets during the German occupation."

Duval looked disappointed.

"Well, I suppose I have mentioned that once or twice before. But there's one other thiug-"

"What's that?"

"When you are caught, I didn't know what you wanted the gear for."

"What, after all the fuss you once made about the scientist's social responsibility for his inventions? Really, Pierre, I'm ashamed of you!"

Stormgren laid down the thick folder of typescript with a sigh of relief.

"Thank heavens that's settled at last," he said. "It's strange to think that these few hundred pages hold the future of mankind. The World State! I never thought I would see it in my lifetime!"

He dropped the file into his brief-case, the back of which was no more than ten centimetres from the dark rectangle of the screen. From time to nine his fingers played across the locks in a half-conscious nervous reaction, but he had no intention of pressing the concealed switch until the meeting was over. There was a chance that something might go wrong: though Duval had sworn that Karellen would detect nothing, one could never be sure.

"Now, you said you'd some news for me," Stormgren continued, with scarcely concealed eagerness. "Is it about-"

"Yes," said Karellen. "I received a decision a few hours ago."

What did he mean by that? wondered Storingren. Surely it was not possible for the Supervisor to have communicated with his distant home, across the unknown numbers of light years that separated him from his base. Or perhaps-this was van

Ryberg's theory-he had merely been consulting some vast computing machine which could predict the outcome of any political action.
"I don't think," continued Karellen, "that the Freedom League and its associates will be very satisfied, but it should help to reduce the tension. We won't record this, by the way.
"You've often told me, Rikki, that no matter how unlike you we are physically, the human race would soon grow accustomed to us. That shows a lack of imagination on your part. It would probably be true in your case, but you must remember that most of the world is still uneducated by any reasonable

standards, and is riddled with prejudices and superstitions that may take decades to eradicate.
"You will grant that we know something of human psychology. We know rather accurately what would happen if we revealed ourselves to the world in its present state of develop-merit. I can't go into details, even with you, so you must accept my analysis on trust. We can, however, make this definite promise, which should give you some satisfaction. In fifty years-two generations from now-we will come down from our ships and humanity will at last see us as we are."
Stormgren was silent for a while, absorbing the Supervisor's words. He felt little of the satisfaction that Karellen's statement would once have given him. Indeed, he was somewhat confused by his partial success, and for a moment his resolution faltered. The truth would come with the passage of time:
all his plotting was unnecessary and perhaps unwise. If he still went ahead, it would be only for the selfish reason that he would not be alive in fifty years.
Karellen must have seen his irresolution, for he continued:
"I'm sorry if this disappoints you, but at least the political problems of the near future won't be your responsibility. Perhaps you will think that our fears are unfounded, but believe me we've had convincing proofs of the danger of any other course."
Stormgren leaned forward, breathing heavily.
"So you have been seen by Man!"
"I didn't say that," Karellen answered promptly. "Your world isn't the only planet we've supervised."
Stormgren was not to be shaken off so easily.
"There have been many legends suggesting that E5L'th has been visited in the past by other races."
"I know: I've read the }Iistorical Research Section's report. It makes Earth look like the crossroads of the Universe."
"There may have been visits about which you know nothing," said Stormgren, still angling hopefully. "Though since you must have been observing us for thousands of years, I suppose that's rather unlikely."
"I suppose it is," replied Karellen, in his most unhelpful manner. And at that moment Stormgren made up his mind.
"Karellen," he said abruptly, "I'll draft out the statement and send it up to you for approval. But I reserve the right to continue pestering you, and if I see any opportunity, I'll do my best to learn your secret."

"I'm perfectly well aware of that," replied the Supervisor, with a slight chuckle.
"And you don't mind?"
"Not in the least-though I draw the line at nuclear weapons, poison gas, or anything else that might strain our friendship."
Stormgren wondered what, if anything, Karellen had guessed. Behind the Supervisor's banter he had recognized the note of understanding, perhaps-who could tell?-even of encouragement.

"I'm glad to know it," Stormgrcn replied in as level a voice as he could manage. He rose to his feet, bringing down the cover of his case as he did so. His thumb slid along the catch.
"I'll draft that statement at once," he repeated, "and send It up on the teletype later today."
While he was speaking, he pressed the button-and knew that all his fears had been groundless. Karellen's senses were no subtler than Man's. The Supervisor could have detected nothing, for there was no change in his voice as he said goodbye and spoke the fRnlili2r code-words that opened the door of the chamber. Yet Stormgren still felt like a shoplifter leaving a department store under the eyes of the house-detective, and breathed a sigh of relief when the smooth wall had sealed itself behind

"I admit," said van Ryberg, "that some of my theories haven't been very successful. But tell me what you think of this one."
"Must I?" sighed Stormgren.
Pieter didn't seem to notice.
"It isn't really my idea," he said modestly. "I got it from a story of Chesterton's. Suppose the Overlords are hiding the fact that they've got nothing to hide?"
"That sounds just a little complicated to me," said Stormgren, beginning to take slight interest.
'What I mean is this," van Ryberg continued eagerly. "I think that physically they're human beings like us. They realize that we'll tolerate being ruled by creatures we imagine to be- well, alien and super-intelligent. But the human race being what it is, it just won't be bossed around by creatures of the same species."

"Very ingenious, like all your theories," said Stormgren.
"I wish you'd give them opus numbers so that I could keep up with them. The objections to this one----" But at that moment Alexander Wainwright was ushered in.
Storzngren wondered what he was thinking. He wondered)
too, if Wainwright had made any contact with the men who had kidnapped him. He doubted it, for he believed Wainwright's disapproval of violence to be perfectly genuine. The extremists in his movement had. discredited themselves thoroughly, and it would be a long time before the world heard of them again.
The head of the Freedom League listened carefully while the draft was read to him. Stormgren hoped he appreciated this gesture, which had been Karellen's idea. Not for another twelve hours would the rest of the world know of the promise that had been made to its grandchildren.
"Fifty years," said Wainwright thoughtfully. "That is a long time to wait."
"For mankind, perhaps, but not for Karellen," Stormgren answered. Only now was he beginning to realize the nearness of the Overlords' solution. It had given them the breathing space they believed they needed, and it had cut the ground from beneath the Freedom League's feet. He did not imagine that the League would capitulate, but its position would be seriously weakened. Certainly Wainwright realized this as well.
"In fifty years," he said bitterly, "the damage will be done. Those who remembered our independence will be dead:
humanity will have forgotten its heritage."
Words-empty words, thought Stormgren. The words for which men had once fought and died, and for which they would never die or fight again. And the world would be better for it.

As he watched Wainwright leave, Stormgren wondered how much trouble the Freedom League would still cause .in the years that lay ahead. Yet that, he thought with a lifting of his spirits, was a problem for his successor.
There were some things that only time could cure. Evil men could be destroyed, but nothing could be done with good men who were deluded.

"Here's your case," said Duval. "It's as good as new."
"Thanks," Storrugren answered, inspecting it carefully none
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the less. "Now perhaps you'll tell me what it was all about, and what we are going to do next."
The physicist seemed more interested in his own thoughts.
"What I can't understand," he said, "is the ease with which we've got away with it. Now if I'd been Kar-"
"But you're not. Get to the point, man. What did we discover?"
"Ah me, these excitable, highly-strung Nordic races!" sighed Duval. "What we did was to make a type of low-powered radar set. Besides radio waves of very high frequency, it used far infra-red-all waves, in fact, which we were sure no creature could possibly see, however weird an eye it had."
"How could you be. sure of that?" asked Stormgren, becoming intrigued by the technical problem in spite of himself.
"Well-we couldn't be quite sure," admitted Duval reluctsntly. "But Karellen views you under normal lighting, doesn't he? So his eyes must be approximately similar to ours in spectral range. Anyway, it worked. We've proved that there is a large room behind that screen of yours. The screen is about three centimetres thick, and the space behind it is at least ten metres across. We couldn't detect any echo from the far wall, but we hardly expected to with the low power which was all we dared use. However, we did get this."
He pushed across a piece of photographic paper on which was a single wavy line. In one spot was a kink like the autograph of a mild earthquake.
"See that little kink?"
"Yes: what is it?"
"Only Karellen."
"Good Lord! Are you sure?"
"It's a pretty safe guess. He's sitting, or standing, or whatever it is he does, about two metres on the other side of the screen. If the resolution had been a bit better, we might even have calculated his size."
Stormgren's feelings were very mixed as he stared at that scarcely visible inflexion of the trace. Until now, there had been no proof that Karellen even had a material body. The evidence was still indirect, but he accepted it without question.
"The other thing we had to do," said Duval, "was to calculate the transmission of the screen to ordinary light. We think we've got a reasonable idea of that-anyway it doesn't matter If we're out even by a factor often. You'll realize, of course,
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that there's no such thing as a truly one-way glass. It's simply
a matter of arranging the lights. Karellen sits in a darkened room: you are illuminated-that's all." Duval chuckled.
"Well, we're going to change that!"
With the air of a conjurer producing a whole litter of white
rabbits, he reached into his desk and pulled out an overgrown
nash-lamp. The'end flared out into a wide nozzle, so that the whole device looked rather like a blunderbuss.
Duval grinned.

"It's not as dangerous as it looks. All you have to do is to tam the nozzle against the screen and press the trigger. It gives out a very powerful beam lasting ten seconds, and in that
dine you'll be able to swing it round the room and get a good view. All the light will go through the screen and it will floodlight your friend beautifully."
"It won't hurt Karellen?"
"Not if you aim low and sweep upwards. That will give his eyes time to adapt-I suppose he has reflexes like ours, and we don't want to blind him."
Stormgren looked at the weapon doubtfully and hefted it in his hand. For the last few weeks his conscience had been pricking him. Karellen bad always treated him with unmistakable affection, despite his occasional devastating frankness, and now that their time together was drawing to its close he did not wish to do anything that might spoil that relationship. But the Supervisor had received due warning, and Stormgren had the conviction that if the choice had been his, Karellen would long ago have shown himself. Now the decision would be made for him: when their last meeting came to its end, Stormgren would gaze upon Karellen's face.
it; of course, Karellen bad a face.

The nervousness that Stormgren had first felt had long since passed away. Karellen was doing almost all the talking, weaving the intricate sentences which he was occasionally prone to use. Once this had seemed to Stormgren the most wonderful and certainly the most unexpected of all Karellen's gifts. Now it no longer appeared quite so marvellous, for he knew that like most of the Supervisor's abilities it was the result of sheer intellectual power and not of any special talent.
Karellen had time for any amount of literary composition

when he slowed his thoughts down to the pace of human speech.
"There is no need for you or your successor to worry unduly about the Freedom League, even when it has recovered from its present despondency. It has been very quiet for the past month, and though it will revive again it will not be a danger for some years. Indeed, since it is always valuable to know what your opponents are doing, the League is a very useful institution. Should it ever get into financial difficulties I might even have to subsidize it."
Stormgren had often found it difficult to tell when Karellen was joking. He kept his face impassive and continued to listen.
"Very soon the League will lose another of its arguments. There has been a good deal of criticism, all somewhat childish, of the special position you have held for the past few years. I found it very valuable in the early days of my administration, but now that the world is moving along the lines that I planned, it can cease. In future, all my dealings with Earth will be in-direct and the office of Secretary-General can revert to something resembling its original form.
"During the next fifty years there will be many crises, but they will pass. The pattern of the future is clear enough, and one day all these difflqilties will be forgotten-even to a race with memories as long as yours."
The last words were spoken with such peculiar emphasis that Stormgren immediately froze in his seat. Karellen, he was sure, never made accidental slips: even his indiscretions were calculated to many decimal places. But there was no time to ask questions-which certainly would not be answered-before the Supervisor had changed the subject again.
"You have often asked me about our long-term plans," he continued. "The foundation of the World State is, of course, only the first step. You will live to see its completion-but the change will be so imperceptible that few will

notice it when it comes. After that there will be a period of slow consolidation while your race becomes prepared for us. And thenwill comethe day which we have promised. lain sorry you will not be there."
Stormgren's eyes were open, but his gaze was fixed far beyond the dark barrier of the screen. He was looking into the future, imagining the day that he would never see, when the great ships of the Overlords came down at last to Earth and were thrown open to the waiting world.
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"On that day," continued Karellen, "the human race will experience what can only be called a psychological discontinuity. But no permanent harm will be done: the men of that age will be more stable than their grandfathers. We will always have been part of their lives, and when they meet us we will not seem so-strange-as we would do to you."
Stormgren had never known Karellen in so contemplative a mood, but this gave him no surprise. He did not believe that he had ever seen more than a few facets of the Supervisor's personality: the real Karellen was unknown and perhaps unknowable to human beings. And once again Stormgren had the feeling that the Supervisor's real interests were elsewhere, and that he ruled Earth with only a fraction of his mind, as effortlessly as a master of three-dimensional chess might play a game of draughts.
"And after that?" asked Stormgren softly.
"Then we can begin our real work."
"I have often wondered what that might be. Tidying up our world and civilizing the human race is only a means-you must have an end as well. Will we ever be able to come out into space and see your universe-perhaps even help you in your tasks?"
"You can put it that way," said Karellen-and now his voice held a clear yet inexplicable note of sadness that left Stormgren strangely perturbed.
"But suppose, after all, your experiment fails with Man? We have known such things in our own dealings with primitive human races. Surely you have your failures too?"
"Yes," said Karellen, so softly that Stormgren could scarcely hear him. "We have had our failures."
"And what do you do then?"
'We wait-and try again."
There was a pause lasting perhaps five seconds. When Karellen spoke again, his words were so unexpected that for a moment Stormgren did not react.
"Good-bye, Rikki!"
Karellen had tricked him-probably it was already too late. Storrngren's paralysis lasted only a moment. Then, with a single swift, well-practised movement, he whipped out the flash gun and jammed it against the glass.
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The pine trees came almost to the edge of the lake, leaving along its border only a narrow strip of grass a few metres wide.
Every evening when it was warm enough Stormgren, despite his ninety years, would walk along this strip to the landing-stage, watch the sunlight die upon the water, and then return to the house before the chill night wind came up from the forest. The simple ritual gave him much contentment, and he would continue it as long as he had the strength.
Far away over the lake something was coming in from the west, flying low and fast. Aircraft were uncommon in these parts, unless one counted the trans-polar liners which must be passing overhead every hour of the day and night. But there was never any sign of their presence, save an occasional vapour trail high against the blue of the stratosphere. This machine was a small helicopter, and

it was coming towards him with obvious determination. Stormgren glanced along the beach
and saw that there was no chance of escape. Then he shrugged his shoulders and sat down on the wooden bench at the head of the jetty.
The reporter was so deferential that Stormgren found it surprising. He had almost forgotten that he was not only an elder statesman but, outside his own country, almost a mythical figure.
"Mr. Stormgren," the intruder began, "I'm very sorry to bother you, but I wonder if you'd care to comment on something we've just heard about the Overlords."
Stormgren frowned slightly. After all these years, he still shared Karellen's dislike for that word.
"I do not think," he said, "that I can add a great deal to what has been written elsewhere."
The reporter was watching him with a curious intentness.
"I thought that you might. A rather strange story has just come to our notice. It seems that, nearly thirty years ago, one of the Science Bureau's technicians made some remarkable equipment for you. We wondered if you could tell us anything about it."
For a moment Stormgren was silent, his mind going back into the past. He was not surprised that the secret had been discovered. Indeed, it was surprising that it had been kept so tong.
He rose to his feet and began to walk back along the jetty, the reporter following a few paces behind.

"The story," he said, "contains a certain amount of truth. On my last visit to Karellen's ship I took some apparatus with
me, in the hope that I might be able to see the Supervisor. It
was rather a foolish thing to do, but-well, I was only sixty at the time."
He chuckled to himself and then continued.
"It's not much of a story to have brought you all this way. You see, it didn't work."
"You saw nothing ?"
"No, nothing at all. I'm afraid you'll have to wait-but
after all, there are only twenty years to go!"
Twenty years to go. Yes, Karellen bad been right. By then the world would be ready, as it had not been when he had spoken that same lie to Duval thirty years ago.
Karellen had trusted him, and Stormgren had not betrayed his faith. He was as sure as he could be of anything that the Supervisor had known his plan from the beginning, and had fbreseen every moment of its final act.
Why else had that enormous chair been already empty when the circle of light blazed upon it! In the same moment he had started to swing the beam, fearing that he was too late. The metal door, twice as high as a man, was closing swiftly when he first caught sight of it-closing swiftly, yet not quite swiftly enough.
Yes, Karellen had trusted him, had not wished him to go down into the long evening of his life haunted by a mystery he could never solve. Karellen dared not defy the unknown powers above him (were they of that same race also?) but he had done all that he could. If he had disobeyed them, they could never prove it.
It was the final proof, Stormgren. knew, of Karellen's affection for him. Though it might be the affection of a man for a devoted and intelligent dog, it was none the less sincere for that, and Stormgren's life had given him few greater satisfactions.
"We have had our failures."
Yes, Karellen, that was true: and were you the one who failed, before the dawn of human history? It must have been a failure indeed, thought Stormgren, for its echoes to roll down all the ages, to haunt the childhood of every race of man.

Even In fifty years, could you overcome the power of all the myths and legends of the world?
Yet Stormgren knew there would be no second failure.
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When the two races met again, the Overlords would have won the trust and friendship of mankind, and not even the shock of recognition could undo that work. They would go together Into the future, and the unknown tragedy that must have darkened the past would be lost forever down the dim corridors of prehistoric time.
And Stormgren hoped that when Karellen was free to walk once more on Earth, he would one day come to these northern forests, and stand beside the grave of the first man to be his friend.

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THE GOLDEN AGE

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"Tins is the day!" whispered the radios in a hundred tongues. "This is the day!" said the headlines of a thousand newspapers. "This is the day!" thought the cameramen as they checked and rechecked the equipment gathered round the vast empty space upon which Karellen's ship would be descending.
There was only the single ship now, hanging above New York. Indeed, as the world had just discovered, the ships above Man's other cities had never existed. The day before, the great fleet of the Overlords had dissolved into nothingness, fading like mists beneath the morning dew.
The supply ships, coming and going far out in space, had been real enough; but the silver clouds that had hung for a lifetime above almost all the capitals of Earth had been an illusion. How it had been done, no-one could tell, but it seemed that every one of those ships had been nothing more than an image of Karellen's own vessel. Yet it had been far more than a matter of playing with light, for radar had also been deceived, and there were still men alive who swore that they had heard the shriek of torn air as the fleet came in through the skies of Earth.
It was not important: all that mattered was that Karellen no longer felt the need for this displayof force. He had thrown away his psychological weapons.
"The ship is moving !" came the word, flashed instantly to every corner of the planet. "It is heading westward!"
At less than a thousand kilometres an hour, falling slowly down from the empty heights of the stratosphere, the ship moved out to the great plains and to its second rendezvous with history. It settled down obediently before the waiting cameras and the packed thousands of spectators, so few of whom coul'~ see as much as the millions gathered round their TV sets.
The ground should have cracked and trembled beneath
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that tremendous weight, but the vessel was still in the grip of whatever forces drove it among the stars. It kissed the earth as gently as a falling snowflake. The curving wall twenty metres above the ground seemed to flow and shimmer: where there had been a smooth and shining surface, a great opening had appeared. Nothing was visible within it, even to the questing eyes of the camera. It was as dark and shadowed as the entrance to a cave.
Out of the orifice, a wide, glittering gangway extruded itself and drove purposefully towards the ground. It seemed a solid sheet of metal with hand-

rails along either side. There were no steps; it was steep and smooth as a toboggan slide and, one would have thought, equally impossible to ascend or descend in any ordinary manner.

The world was watching that dark portal, within which nothing had yet stirred. Then the seldom-heard yet unfor-. gettable voice of Karellen floated softly down from some hidden source. His message could scarcely have been more unexpected

"There are some children by the foot of the gangway. I would like two of them to come up and meet me."

There was silence for a moment. Then a boy and a girl broke from the crowd and walked, with complete lack of self-consciousness, towards the gangway and into history. Others followed, but stopped when Karellen's chuckle came from the ship.

"Two will be enough."

Eagerly anticipating the adventure, the children-they could not have been more than six years old-jumped on to the metal slide. Then the first miracle happened.

Waving cheerfi.illy to the crowds beneath, and to their anxious parents-who, too late, had probably remembered the legend of the Pied Piper-the children began swiftly ascending the steep slope. Yet their legs were motionless, and soon it was clear also that their bodies were tilted at right angles to that peculiar gangway. It possessed a private gravity of its own, one which could ignore that of Earth. The children were still enjoying this novel experience, and wondering what was drawing them upwards, when they disappeared into the ship.

A vast silence lay over the whole world for the space of twenty seconds-though, afterwards, no-one could believe that the time had been so short. Then the darkness of the

great opening seemed to move forward, and Karellen came forth into the sunlight. The boy was sitting on his left arm, the girl on his right. They were both too busy playing with Karellen's wings to take any notice of the watching multitude. It was a tribute to the Overlords' psychology, and to their careful years of preparation, that only a few people fainted. Yet there could have been fewer still, anywhere in the world, who did not feel the ancient terror brush for one awful instant against their minds before reason banished it forever.

There was no mistake. The leathery wings, the little horns, the barbed tail-all were there. The most terrible of all legends had come to life, out of the unknown past. Yet now it

stood smiling, in ebon majesty, with the sunlight gleaming upon its tremendous body, and with a human child resting trustfully on either arm.

6

Furry years is ample time in which to change a world and its people almost beyond recognition. All that is required for the task are a sound knowledge of social engineering, a clear sight of the intended goal-and power.

These things the Overlords possessed. Though their goal was hidden, their knowledge was obvious-and so was their power.

That power took many forms, few of them realized by the peoples whose destinies the Overlords now ruled. The might enshrined in their great ships had been clear enough for every eye to see. But behind that display of sleeping force were other and much subtler weapons.

"All political problems," Karellen had once told Stormgren, "can be solved by the correct application of power."

"That sounds a rather cynical remark," Stormgren had replied doubtfully. "It's a little too much like 'Might is Right'. In our own past, the use of power has been notably unsuccessflu in solving anything."

"The operative word is correct. You have never possessed real power, or the knowledge necessary to apply it. As in all problems, there are efficient and inefficient approaches. Suppose, for example, that one of your nations, led by some
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fanatical ruler, tried to revolt against me. The highly inefficient answer to such a threat would be some billions of horsepower in the shape of atomic bombs. If I used enough bombs, the solution would be complete and finèi. It would also, as I remarked, be inefficient-even if it possessed no other defects."
"And the efficient solution?"
"That requires about as much power as a small radio transmitter-and rather similar skills to operate. For it's the application of the power, not its amount, that matters. How long do you think Hitler's career as dictator of Germany would have lasted, if wherever he went a voice was talking quietly in his ear? Or if' a steady musical note, loud enough to drown all other sounds and to prevent sleep, filled his brain night and day? Nothing brutal, you appreciate. Yet, in the final analysis, just as irresistible as a tritium bomb."
"I see," said Stormgren; "and there would be no place to hide?"
"No place where I could not send my-ah-devices if I felt sufficiently strongly about it. And that is why I shall never have to use really drastic methods to maintain my position."
The great ships, then, had never been more than symbols, and now the world knew that all save one had been phantoms.
Yet, by their mere presence, they had changed the history of Earth. Now their task was done, and their achievementlingered behind them to go echoing down the centuries.
Karellen's calculations had been accurate. The shock of revulsion had passed swiftly, though there were many who prided themselves on their freedom from superstition yet would never be able to face one of the Overlords. There was something strange here, something beyond all reason or logic.
In the Middle Ages, people believed in the devil and feared him. But this was the twenty-first century: could it be that, after all, there was such a thing as racial memory?
It was, of course, universally assumed that the Overlords, or beings of the same species, had come into violent conflict with ancient man. The meeting must have lain in the remOte past, for it had left no traces in recorded history. Here was another puzzle, and Karellen would give no help in its solution.
The Overlords, though they had now shown themselves to man, seldom left their one remaining ship. Perhaps they found it physically uncomfortable on Earth, for their size, and the existence of their wings, indicated that they came from
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a world of much lower gravity. They were never seen without a belt adorned with complex mechanisms which, it was generally believed, controlled their weight and enabled them to communicate with each other. Direct sunlight was painful to them, and they never stayed in it for more than a few seconds. When they had to go into the open for any length of time, they wore dark glasses which gave them a somewhat incongruous appearance. Though they seemed able to breathe terrestrial air, they sometimes carried small cylinders of gas from which they refreshed themselves occasionally.
Perhaps these purely physical problems accounted fbr their aloofness. Only a small fraction of the human race had ever actually met an Overlord in the flesh, and no-one could guess how many of them were aboard Karellen's ship. No more than five had ever been seen together at one time, but there might be hundreds, even thousands of them aboard that tremendous vessel.
In many ways, the appearance of the Overlords had raised more problems than it had solved. Their origin was still no-known, their biology a source of endless speculation. On many matters they would give information freely, but on others

their behaviour could only be described as secretive. On the whole, however, this did not annoy anyone except the scientists. The average man, though he might prefer not to meet the Overlords, was grateflil to them for what they had done to his world.

By the standards of all earlier ages, it was Utopia. Ignorance, disease, poverty and fear had virtually ceased to exist. The memory of war was fading into the past as a nightmare vanishes with the dawn: soon it would lie outside the experience of all living men.

With the energies of mankind directed into constructive channels, the face of the world had been remade. It was, almost literally, a new world. The cities that had been good enough for earlier generations had been rebuilt-or deserted and left as museum specimens when they had ceased t~ serve any useful purpose. Many cities had already been abandoned in this manner, for the whole pattern of industry and commerce had changed completely. Production had become largely automatic: the robot factories poured forth consumer goods in such unending streams that all the ordinary necessities of life were virtually free. Men worked for the sake of the luxuries they desired: or they did not work at all.

It was One World. The old names of the old countries were still used, but they were no more than convenient postal divisions. There was no-one on earth who could not speak English, who could not read, who was not within range of a television set, who could not visit the other side of the planet within twenty-four hours..

Crime had practically vanished. It had become both no-necessary and impossible. When no-one lacks anything, there is no point in stealing. Moreover, all potential criminals knew that there could be no escape from the surveillance of the Overlords. In the early days of their rule, they had intervened so effectively on behalf of law and order that the lesson had never been forgotten. Crimes of passion, though not quite extinct, were almost unheard of. Now that so many of its psychological problems had been removed, humanity was far saner and less irrational. And what earlier ages would have called vice was now no more than eccentricity-or, at the worst, bad manners.

One of the most noticeable changes had been a slowing-down of the mad tempo that had so characterized the twentieth century. Life was more leisurely than it had been for generations. It therefore had less zest for the few, but more tranquillity for the many. Western man had relearned-what the rest of the world had never forgotten-that there was nothing sinful in leisure as long as it did not degenerate into mere sloth.

Whatever problems the future might bring, time did not yet hang heavy on humanity's hands. Education was now much more thorough and much more protracted. Few people left college before twenty-and that was merely the first stage, since they normally returned again at twenty-five for at least three more years, after travel and experience had broadened their minds. Even then, they would probably take refresher ~urses at intervals for the remainder of their lives in the subjects that particularly interested them.

This extension of human apprenticeshi~ so far past the beginning of physical maturity had given rise to many social changes. Some of these had been necessary for generations, but earlier periods had refused to face the challenge-or had pretended that it did not exist. In particular, the pattern of sexual mores-insofar as there had ever been a single pattern- ~ad altered radically. It had been virtually shattered by two

inventions, which were, ironically enough, of purely human ~rn and owed nothing to the Overlords.

The first was a completely reliable oral contraceptive: the 3econd was an equally infallible method-as certain as fingerprinting, and based on a very detailed analysis of the blood- of identifying the father of any child. The

effect of these two inventions upon human society could only be described as devastating, and they had swept away the last remnants of the Puritan aberration.

Another great change was the extreme mobility of the new society. Thanks to the perfection of air-transport, everyone
was free to go anywhere at a moment's notice. There was more room in the skies than there had ever been on the roads, and the, twenty-first century had repeated, on a larger scale, the great American achievement of purnng a nation on wheels.

It had given wings to the world.

Though not literally. The ordinary private flyer or air-car
had no wings at all, or indeed any visible control surfaces.
Even the clumsy rotor blades of the old helicopters had been
banished. Yet Man had not discovered anti-gravity: only the Overlords possessed that ultimate secret. His air-cars were propelled by forces which the Wright brothers would have understood. Jet reaction, used both directly and in the more subtle fbrm of boundary layer control, drove his flyers forward and held them in the air. As no laws or edicts of the Overlords could have done, the ubiquitous little air-cars had washed away the last barriers between the different tribes of mankind.

Profounder things had also passed. It was a completely secular age. Of the faiths that had existed before the coming of the Overlords, only a forn~ of purified Buddhism-perhaps the most austere of all religions-still survived. The creeds that had been based upon miracles and revelations had collapsed utterly. With the rise of education, they had already been slowly dissolving, but for a while the Overlords had taken no sides in the matter. Though Karellen was often asked to express his views on religion, all that he would say was that a man's belieft were his own affair, so long as they did not interfere with the liberty of others.

Perhaps the old faiths would have lingered for generations yet, had it not been for human curiosity. It was known that the Overlords had access to the past, and more than once historians had appealed to Karellen to settle some ancient contro
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versy. It may have been that he had grown tired of such questions, but it is more likely that he knew perfectly well what the outcome of his generosity would be....

The instrument he handed over on permanent loan to the World History Foundation was nothing more than a television receiver with an elaborate set of controls for determining coordinates in time and space. It must have been linked somehow to a far more complex machine, operating on principles that no-one could imagine, aboard Karellen's ship. One had merely to adjust the controls, and a window into the past was opened up. Almost the whole of human history for the past five thousand years became accessible in an instant. Earlier than that the machine would not go, and there were bafihing blanks all down the ages. They might have had some natural cause, or they might be due to deliberate censorship by the Overlords.

Though it had always been obvious to any rational mind that all the world's religious writings could not be true, the shock was nevertheless profound. Here was a revelation which no-one could doubt or deny: here, seen by some unknown magic of Overlord science, were the true beginnings of all the world's great faiths. Most of them were noble and inspiring- but that was not enough. Within a few days, all mankind's multitudinous messiahs had lost their divinity. Beneath the fierce and passionless light of truth, faiths that had sustained millions for twice a thousand years vanished like morning dew. All the good and all the evil they had wrought were swept suddenly into the past, and could touch the minds of men no more.

Humanity had lost its ancient gods: now it was old enough to have no need for new ones.

Though few realized it as yet, the fall of religion bad been paralleled by a decline in science. There were plenty of technologists, but few original workers extending the frontiers of human knowledge. Curiosity remained, and the leisure to mdulge in it, but the heart had been taken out of fundamental scientific research. It seemed futile to spend a lifetime search-tog fur secrets that the Overlords had probably uncovered ages before.

This decline had been partly disguised by an enormous efflorescence of the descriptive sciences such as zoology, botany and observational astronomy. There had never been so

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many amateur scientists gathering facts for their own amusement-but there were few theoreticians correlating these facts.

The end of strife and conflicts of all kinds had also meant the virtual end of creative art. There were myriads of performers, amateur and professional, yet there had, been no really outstanding new works of literature, music, painting or sculpture for a generation. The world was still living on the glories of a past that could never return.

No-one worried except a few philosophers. The race was too intent upon savouring its new-found freedom to look beyond the pleasures of the present. Utopia was here at last: its novelty had not yet been assailed by the supreme enemy of all Utopias-boredom.

Perhaps the Overlords had the answer to that, as they had to all other problems. No-one knew-any more than they knew, a lifetime after their arrival-what their ultimate purpose might be. Mankind had grown to trust them, and to accept without question the superhuman altruism that had kept Karellen and his companions so long exiled from their homes.

If, indeed, it was altruism. For there were still some who wondered if the policies of the Overlords would always coincide with the true welfare of humanity.

7

WHEN Rupert Boyce sent out the invitations for his party, the total mileage involved was impressive. To list only the first dozen guests, there were the Fosters from Adelaide, the Shoenbergers from Haiti, the Farrans from Stalingrad, the Moravias from Cincinnati, the Ivankos from Paris, and the Sullivans from the general vicinity of Easter Island, but approximately four kilometres down on the ocean bed. It was a considerable compliment to Rupert that although thirty guests had been invited, over forty turned up-which was about the percentage he had expected. Only the Krauses let him down, and that was simply because they forgot about the International Date Line and arrived twenty-four hours late.

By noon an imposing collection of flyers had accumulated in

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the park, and the later arrivals would have quite a distance to walk once they had found somewhere to land. At least, it would seem quite a distance to them, under this doudless sky and with the mercury at a hundred and ten. The assembled vehicles ranged from one-man Flitterbugs to family Cadillacs which were more like air-borne palaces than sensible flying machines. In this age, however, nothing could be deduced concerning the social status of the guests from their modes of transport.

"It's a very z~g1y house," said Jean Morrel as the Meteor spiralled down. "It looks rather like a box that somebody's stepped on."

George Greggson, who had an old-fashioned dislike of automatic landings, readjusted the rate-of-descent control before answering.

"It's hardly fair to judge the place from this angle," he replied, sensibly enough. "From ground level it may look quite different. Oh dear!"
"What's the matter?"
"The Fosters are here. I'd recognize that colour-scheme anywhere."
"Well, there's no need to talk to them if you don't want to. That's one advantage of Rupert's parties-you can always hide in the crowd."
George had selected a landing place and was now diving purposefully towards it. They floated to rest between another Meteor and something that neither of them could identify. It looked very fast and, Jean thought, very uncomfortable. One of Rupert's technical friends, she decided, had probably built it himself. She had an idea that there was a law against that sort of thing.
The heat hit them like a blast from a blow-torch as they stepped out of the flyer. It seemed to suck the moisture from their bodies, and George almost imagined that he could feel his skin cracking. It was partly their own fault, of course.
They had left Alaska three hours before, and should have remembered to adjust the cabin temperature accordingly.
"What a place to live!" gasped Jean. "I thought this climate was supposed to be controlled."
"So it is," replied George. "This was all desert once-and look at it now. Come on-it'll be all right indoors!"
Rupert's voice, slightly larger than life, boomed cheerfully

in their ears. Their host was standing beside the flyer, a glass in each hand, looking down at them with a roguish expression.
He looked down at them for the simple reason that he was about twelve feet tall: he was also semi-transparent. One could see right through him without much difficulty.
"This is a fine trick to play on your guests!" protcsted
George. He grabbed at the drinks, which he could just reach.
His hand, of course, went right through them. "I hope you've got something more substantial for us when we reach the house!"
"Don't worry!" laughed Rupert. "Just give your order now, and it'll be ready by the time you arrive."
"Two large beers, cooled in liquid air," said George promptly. 'We'll be right there."
Rupert nodded, put down one of his glasses on an invisible table, adjusted an equally invisible control, and promptly vanished from sight.
"Well!" said Jean. "That's the first time I've seen one of those gadgets in action. How did Rupert get hold of it? I thought only the Overlords had them."
"Have you ever known Rupert not to get anything he wanted?" replied George. "That's just the toy for him. He can sit comfortably in his studio and go wandering round half of Africa. No heat, no bugs, no exertion-and the icebox always in reach. I wonder what Stanley and Livingstone would have thought?"
The sun put an end to further conversation until they had reached the house. As they approached the front door (which was not very easy to distinguish from the rest of the glass wall facing them) it swung automatically open with a fanfare of trumpets. Jean guessed, correctly, that she would be heartily sick of that fanfare before the day was through.
The current Mrs. Boyce greeted them in the delicious coolness of the hail. She was, if truth be known, the main reason for the good turn-out of guests. Perhaps half of them would have come in any case to see Rupert's new house: the waverers had been decided by the reports of Rupert's new wife.
There was only one adjective that adequately described her. She was distracting. Even in a world where beauty was almost commonplace, men would turn their heads when she entered the room. She was, George guessed, about one quarter Negro; her features were practically Grecian and her hair was long and

lustrous. Only the dark, rich texture of her skin-the overworked word "chocolate" was the only one that described it- revealed her mixed ancestry.
"You're Jean and George, aren't you?" she said, holding out her hand. "I'm so pleased to meet you. Rupert is doing something complicated with the drinks-come along and meet everybody."
Her voice was a rich contralto that sent little shivers running up and down George's back, as if someone was playing on his spine like a flute. He looked nervously at Jean, who had managed to force a somewhat artificial smile, and finally recovered his voice.
"It's-it's verynice to meet you," he said lamely. 'We've been looking forward to this party."
"Rupert always gives such nice parties," put in Jean. By the way she accented the "always", one knew perfectly well she was thinking "Every time he gets married". George flushed slightly and gave Jean a glance of reproof, but there was no sign that their hostess noticed the barb. She was friendliness itself as she ushered them into the main lounge, already half packed with a representative collection of Rupert's numerous friends. Rupert himself was sitting at the console of what seemed to be a television engineer's control unit: it was, George assumed, the device that had projected his image out to meet them. He was busily demonstrating it by surprising two more arrivals as they descended into the parking place, but paused just long enough to greet Jean and George and to apologize for having given their drinks to somebody else.
"You'll find plenty more over there," he said, waving one hand vaguely behind him while he adjusted controls with the other. "Just make yourselves at home. You know most of the people here-Maia will introduce you to the rest. Good of you to come."
"Good of you to invite us," said Jean, without much conviction. George had already departed towards the bar and she made her way after him, occasionally exchanging greetings with someone she recognized. About three-quarters of those present were perfect strangers, which was the normal state of affairs at one of Rupert's parties.
"Let's explore," she said to George when they had refreshed themselves and waved to everyone they knew. "I want to look at the house."

George, with a barely concealed backward look at Maia Boyce, followed after her. There was a faraway look in his eyes that Jean didn't like in the least. It was such a nuisance that men were fundamentally polygamous. On the other hand, if they weren't. . . Yes, perhaps it was better this way, after
511.
George quickly came back to normal as they investigated the wonders of Rupert's new abode. The house seemed very large for two people, but this was just as well in view of the frequent overloads it would have to handle. There were two storeys, the upper considerably larger so that it overhung and provided shade around the ground floor. The degree of mechanization was considerable, and the kitchen closely resembled the cockpit of an airliner.
"Poor Ruby!" said Jean. "She would have loved this place."
"From what I've heard," replied George, who had no great sympathy for the last Mrs. Boyce, "she's perfectly happy with her Australian boy-friend."
This was such common knowledge that Jean could hardly contradict it, so she changed the subject.
"She's awfully pretty, isn't she?"
George was sufficiently alert to avoid the trap.
"Oh, I suppose so," he replied indifferently. "That is, of course, if one likes brunettes."
"Which you don't, I rake it," said Jean sweetly.

"Don't be jealous, dear," chuckled George, stroking her platinum hair. "Let's go and look at the library. What floor do you think that will be on?"
"It must be up here: there's no more room down below. Besides, that fits in with the general design. All the living, eating, sleeping and so on's relegated to the ground flopr. This is the fun and games department-though I still think it's a crazy idea having a swimming-pool upstairs."
"I guess there's some reason for it," said George, opening a door experimentally. "Rupert must have had skilled advice when he built this place. I'm sure he couldn't have done it himself."
"You're probably right. If he had, there'd have been rooms without doors, and stairways leading nowhere. In fact, I'd be afraid to step inside a house that Rupert had designed all by himself."
"Here we are," said George, with the pride of a navigator

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making landfall, "the fabulous Boyce collection in Its new home. I wonder just how many of them Rupert has really read."
The library ran the whole width of the house, but was virtually divided into half a dozen small rooms by the great bookcases extending across it. These held, if George remembered correctly, some fifteen thousand volumes-almost everything of importance that had ever been published on the nebulous subjects of magic, psychic research, divining, telepathy, and the whole range of elusive phenomena lumped in the category of paraphysics. It was a very peculiar hobby for anyone to have in this age of reason. Presumably it was simply Rupert's particular form of escapism.
George noticed the smell the moment he entered the room.
It was faint but penetrating, not so much unpleasant as puzzling. Jean had observed it too: her forehead was wrinkled in the effort of identification. Acetic acid, thought George- that's the nearest thing to it. But it's got something else as well....
The library terminated in a small open space just large enough for a table, two chairs and some cushions. This, presumably, was where Rupert did most of his reading. Someone was reading there now, in an unnaturally dim light.
Jean gave a little gasp and clutched at George's hand. Her reaction was, perhaps excusable. It was one thing to watch a television picture, quite another to meet the reality. George, who was seldom surprised by anything, rose to the occasion at once.
"I hope we haven't disturbed you, sir," he said politely. 'We'd no idea that there was anyone here. Rupert never told us...."
The Overlord put down the book, looked at them closely, then commenced reading again. There was nothing impolite about the action, coming as it did from a being who could read, talk, and probably do several other things at the same time. Nevertheless, to human observers the spectacle was disturbingly schizophrenic.
"My name is Rashaverak," said the Overlord amiably. "I'm afraid I'm not being very sociable, but Rupert's library is a difficult place from which to escape."
Jean managed to suppress a nervous giggle. Their unexpected fellow guest was, she noticed, reading at the rate of a

page every two seconds. She did not doubt that he was assimilating every word, and she wondered if he could manage to read a book with each eye. "And then, of course," she thought to herself, "he could go on to learn braille so he could use his fingers. . . ." The resulting mental picture was too comic to be comfortable, so she tried to suppress it by entering into the conversation. After all, it was not every day that one had a chance of talking to one of the masters of Earth.

George let her chatter on, after he had made the introductions, hoping that she wouldn't say anything tactless. Like Jean, he bad never seen an Overlord in the flesh. Though they mixed socially with government officials, scientists and others who dealt with them in the course of business, he had never heard of one being present at an ordinary private party. One inference was that this party was not as private as it seemed. Rupert's possession of a piece of Overlord equipment also hinted at this, and George began to wonder, in capital letters, just What Was Going On. He would have to tackle Rupert about this when he could get him into a corner.

Since the chairs were too small for him, Rashaverak was sitting on the floor, apparently quite at ease since he had ignored the cushions only a metre away. As a result his head was a mere two metres from the ground, and George had a unique chance of studying extra-terrestrial biology. Unfortunately, as he knew little about terrestrial biology, he was not able to learn much that he did not already know. Only the peculiar, and by no means unpleasant, acid odour was new to him. He wondered how humans smelt to the Overlords, and hoped for the best.

There was nothing anthropomorphic about Rashaverak.

George could understand the way in which, if seen from a distance by ignorant, terrified savages, the Overlords could be mistaken for winged men, and so could have given rise, to the conventional portrait of the Devil. From as clOse as this, however, some of the illusion vanished. The little horns (what function did they serve? wondered George) were as per specification, but the body was neither like that of a man nor of any animal Earth had ever known. Coming from a totally alien evolutionary tree, the Overlords were neither m~mmnIs, insects, nor reptiles. It was not even certain that they were vertebrates: their hard, external armour might well be their only supporting framework.

Rashaverak's wings were folded so that George could not see them dearly, but his tail, looking like a piece of armoured hose-pipe, lay neatly curled under him. The famous barb was not so much an arrowhead as a large, flat diamond. Its purpose, it was now generally accepted, was to give stability in flight, like the tail-feathers of a bird. From scanty facts and suppositions such as these, scientists had concluded that the Overlords came from a world of low gravity and very dense atmosphere.

Rupert's voice suddenly bellowed from a concealed speaker.

"Jean! George! Where the hell are you hiding? Come down and join the party. People are beginning to talk."

"Perhaps I'd better go too," said Rashaverak, putting his book back on the shelf~ He did that quite easily, without moving from the floor, and George noticed for the first time that he had two opposed thumbs, with five fingers between them. I'd hate to do arithmetic, George thought to himself, in a system based on fourteen.

Rashaverak getting to his feet was an impressive sight, and as the Overlord bent to avoid the ceiling it became obvious that, even if they were anxious to mix with human beings, the practical difficulties would be considerable.

Several more cargoes of guests had arrived in the last half hour, and the room was now quite crowded. Rashaverak's arrival made matters a good deal worse, because everyone in the adjacent rooms came running in to see him. Rupert was obviously very pleased with the sensation. Jean and George were much less gratified, as no-one took any notice of them. Indeed, few people could see them, because they were standing behind the Overlord.

"Come over here, Rashy, and meet some of the folks," shouted Rupert. "Sit on the divan-then you can stop scraping the ceiling."

Rashaverak, his tail draped over his shoulder, moved across the room like an icebreaker worrying its way through a pack. As he sat down beside Rupert, the room seemed to become much larger again and George let out a sigh of relief.

"It gave me claustrophobia when he was standing. I wonder how Rupert got hold of him-this looks like being an interesting party."
"Fancy Rupert addressing him like that, in public too. But he didn't seem to mind. It's all very peculiar."
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"I bet you he did mind. The trouble with Rupert Is that he likes to show oft; and he's got no tact. And that reminds me- some of those questions you asked!"
"Such as?"
"Well-'How long have you been here?' 'How do you get on with Supervisor Karellen?' 'Do you like it on Earth?'
Really, darling! You just don't talk to Overlords that way!"
"I don't see why not. It is about time someone did."
Before the discussion could get acrimonious, they were accosted by the Shoenbergers and fission rapidly occurred. The girls went off in one direction to discuss Mrs. Boyce: the men went in another and did exactly the same thing, though from a different viewpoint. Benny Shoenberger, who was one of George's oldest friends, had a good deal of information on the subject.
"For heaven's sake don't tell anyone," he said. "Ruth doesn't know this, but I introduced her to Rupert."
"I think," George remarked enviously, "that she's much too good for Rupert. However, it can't possibly last. She'll soon get fed up with him." This thought seemed to cheer him considerably.
"Don't you believe it! Besides being a beauty, she's a really nice person. It's high time someone took charge of Rupert, and she's just the girl to do it."
Both Rupert and Maia were now sitting beside Rashaverak, receiving their guests in state. Ruperf S parties seldom had any focal point, but usually consisted of half a dozen independent groups intent on their own affairs. This time, however, the whole gathering was polarized towards a centre of attraction.
George felt rather sorry for Maia. This should have been her day, but Rashaverak had partially eclipsed her.
"Look," said George, nibbling at a sandwich. "How the devil has Rupert got hold of an Overlord? I've never heard of such a thing-but he seems to take it for granted. He never even mentioned it when he invited us."
Benny thudded.
"Just another of his little surprises. You'd better ask him about it. But this isn't the first time it's happened, after all. Karellen's been to parties at the White House and Buckingham Palace, and-"
"Heck, that's different! Rupert's a perfectly ordinary citizen."
72
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"And maybe Rashaverak's a very minor Overlord. But you'd better ask them."
"I will," said George, "just as soon as I can get Rupert by himself."
"Then you'll have to wait a long time."
Benny was right, but as the party was now warming up it was easy to be patient. The slight paralysis which the appearance of Rashaverak had cast over the assembly had now vanished. There was still a small group around the Overlord, but elsewhere the usual fragmentation had taken place and everyone was behaving quite naturally. Sullivan, for example, was describing his latest submarine research to an interested audience.
"We're not sure, yet," he said, "just how big they grow.
There's a canyon not far from our base where a real giant lives.
I've caught a glimpse of it once, and I'd say that its tentacle-spread is the best part of thirty metres. I'm going in after it next week. Anyone like something really novel in the way of pets?"
There was a squeal of horror from one of the women.
"Ugh! It gives me the creeps just to think about it! You must be terribly brave."

Sullivan looked quite surprised.
"I'd never thought about that," he said. "Of course, I take suitable precautions, but I've never been in any real danger.
The squids know that they can't eat me, and as long as I don't go too close they never take the slightest notice. Most sea-creatures leave you alone unless you interfere with them."
"But surely," someone asked, "sooner or later you're bound to run up against one that thinks you're edible?"
"Oh," replied Sullivan airily, "that happens now and then.
I try not to hurt them, because after all I'm anxious to make friends. So I just turn the jets full on and it usually takes onl a minute or two to pull free. If I'm too busy to stop and play, may tidde them up with a couple of hundred volts. That settles the matter and they never bother me again."

You certainly met some interesting people at Rupert's parties, thought George as he moved on to the next group.
Rupert's literary tastes might be specialized, but his friendships were wide-ranging. Without bothering to turn his head, George could see a famous film producer, a minor poet, a mathematician, two actors, an atomic power engineer, a game warden,

the editor of a weekly news magazine, a statistician from the World Bank, a violin virtuoso, a professor of arth~ology and an astrophysicist. There were no other representatives of George's own profession, television studio design-which was
a good thing, as he wanted to get away from shop. He loved his work: indeed, in this age, for the first time in human history, no-one worked at tasks they did not like. But George was content to mentally lock the studio doors behind him at the
end of the day.
He finally trapped Rupert in the kitchen, experimenting wlthdrinks. It seemed apitytobringhim backto earth when he had such a far-away look in his eye, but George could be ruthless when necessary.
"Look here, Rupert," he began, perching himself on the nearest table. "I thipk you owe us all some explanation."
"Um," said Rupert thoughtfully, rolling his tongue round his mouth. "Just a teeny bit too much gin, I'm afraid."
"Don't hedge, and don't pretend you're not still sober, because I know perfectly well you are. Where does your Overlord friend come from, and what's he doing here?"
"Didn't I tell you?" said Rupert. "I thought I'd explained it to everybody. You couldn't have been around-of course, you were hiding up in the library." He thudded in a manner which George found offensive. "It's the library, you know, that brought Rashy here."
"How extraordinary!"
"Why?"
George paused, realizing that this would require tact. Rupert was very proud of his peculiar collection.
"Er-well, when you consider what the Overlords know about science, I should hardly think they'd be interested in psychic phenomena and all that sort of nonsense."
"Nonsense or not," replied Rupert, "they're interested in human psychology, and I've got some books that can teach them a lot. Just before I moved here some Deputy Under-Overlord, or Over-Underlord, got in touch with me and asked if they could borrow about fifty of my rarest volumes. One of the keepers of the British

Museum Library had put him on to me, it seemed. Of course, you can guess what I said."
"I can't imagine."
"Well, I replied very politely that it had taken metwenty years to get my library together. They were welcome to study
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my books, but they'd darn well have to read them here. So
Rasby came along and has been absorbing about twenty volumes a day. I'd love to know what he makes of them."
George thought this over, then shrugged his shoulders in disgust.
"Frankly," he said, "my opinion of the Overlords goes down. I thought they had better things to do with their time."
"You're an incorrigible materialist, aren't you? I don't think Jean will agree at all. But even from your oh-so-practical viewpoint, it-still makes sense. Surely you'd study the superstitions of any primitive race you were having dealings with!"
"I suppose so," said George, not quite convinced. The table-top was feeling hard, so he rose to his feet. Rupert had now mixed the drinks to his satisfaction and was heading back to his guests. Querulous voices could already be heard demanding his presence.
"Hey!" protested George, "just before you disappear there's one other question. How did you get hold of that two-way television gadget you tried to frighten us with?"

"Just a bit of bargaining. I pointed out how valuable it would be for a job.like mine, and Rashy passed the suggestion on to the right quarters."
"Forgive me for being so obtuse, but what is your new job? I suppose, of course, it's something to do with animals."
"That's right. I'm a super-vet. My practice covers about ten thousand square kilometres of jungle, and as my patients won't come to inc I've got to look for them."
"Rather a full-time job."
"Oh, of course it isn't practical to bother about the small fry. Just lions, elephants, rhinos, and so on. Every morning I set the controls for a height of a hundred metres, sit down in front of the screen and go cruising over the countryside. When I find anyone in trouble I climb into my flyer and hope my bedside manner will work. Sometimes it's a bit tricky. Lions and such-like are easy-but trying to puncture a rhino from the air with an an~sthetic dart is the devil of a job."
"RuPERT!" yelled someone from the next room.
"Now look what you've done! You've made me forget my guests. There-you take that tray. Those are the ones with vermouth-I don't want to get them mixed up."
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It was just before sunset that George found his way up to the roof. For a number of excellent reasons he had a slight headache and ftlt like escaping front the noise and confusion downstairs. Jean, who was a much better dancer than he was, still seemed to be enjoying herself hugely and refused to leave. This annoyed George, who was beginning to feel alcoholically amorous, and he decided to have a quiet sulk beneath the stars.
One reached the roof by taking the escalator to the first floor
and then climbing the spiral stairway round the intake of the
air-conditioning plant. This led, through a hatchway, out on to the wide, flat roof. Rupert's flyer was parked at one end: the centre area was a garden-already showing signs of running
wild-and the rest was simply an observation platform with a few deckchairs placed on it. George flopped into one of these and regarded his surroundings with an imperial eye. He felt very much monarch of all he surveyed.

It was, to put it mildly, quite a view. Rupert's house had been built on the edge of a great basin, which sloped downwards towards the east into swamplands and lakes five kilo-metres away. Westwards the land was flat and the jungle came almost to Rupert's back-door. But beyond the jungle, at a distance that must have been at least fifty kilometres, a line of mountains ran like a great wall out of sight to north and south.

Their summits were streaked with snow, and the clouds above them were turning to fire as the sun descended on the last few minutes of its daily journey. As he looked at those remote ramparts, George felt awed into a sudden sobriety.

The stars that sprang out in such indecent haste the moment the sun had set were completely strange to him. He looked for the Southern Cross, but without success. Though he knew very little of astronom.y, and could recognize only a few constellations, the absence of familiar friends was disturbing. So were the noises drifting in from the jungle, uncomfortably close at band. Enough of this fresh air, thought George. I'll go back to the party before a vampire bat, or something equally pleasant, comes flying up to investigate.

He was just starting to walk back when another guest emerged from the hatchway. It was now so dark that George could not see who it was, so he called out: "Hello, there. Have you had enough of it too?" His invisible companion laughed. "Rupert's starting to show some of his movies. I've seen them all before."

"Have a cigarette," said George.

"Fhanks."

By the flame of the lighter-George was fond of such antiques-he could now recognize his fellow-guest, a strikingly handsome young negro whose name George had been told but had immediately forgotten, like those of the twenty other complete strangers at the party. However, there seemed something familiar about him, and suddenly George guessed the truth.

"I don't think we've really met," he said, "but aren't you Rupert's new brother-in-law?"

"That's right. I'm Jan Rodricks. Everyone says that Mala and I look rather alike."

George wondered whether to commiserate with Jan for his newly acquired relative. He decided to let the poor fellow find out for himself; after all, it was just possible that Rupert would settle down this time.

"I'm George Greggson. This is the first time you've been to one of Rupert's famous parties?"

"Yes. You certainly meet a lot of new people this way."

"And not only humans," added George. "This is the first chance I've had of meeting an Overlord socially."

The other hesitated for a moment before replying, and George wondered what sensitive spot he had struck. But the answer revealed nothing.

"I've never seen one before, either-except of course on TV."

There the conversation languished, and after a moment George realized that Jan wanted to be alone. It was getting cold, anyway, so he took his leave and re-joined the party.

The jungle was quiet now; as Jan leaned against the curving wall of the air intake, the only sound he could hear was the faint murmur of the house as It breathed through its mcdianical lungs. He felt very much alone, which was the way he wanted to be. He also felt highly frustrated-and that was something he had no desire to be at all.

8

No Utopia can ever give satisfaction to everyone, all the time.

As their material conditions improve, men raise their sights and become discontented with powers and possessions that once would have seemed beyond

their wildest dreams. And even when the external world has granted all it can, there still remain the searchings of the mind and the longings of the heart.
Jan Rodricks, though he seldom appreciated his luck, would have been even more discontented in an earlier age. A century before, his colour would have been a tremendous, perhaps an overwhelming, handicap. Today, it meant nothing. The inevitable- reaction that had given early twenty-first-century negroes a slight sense of superiority had already passed away.
The convenient word "nigger" was no longer tabu in polite society, but was used without embarrassment by everyone. It had no more emotional content than such labels as republican or methodist, conservative or liberal.
Jan's father had been a charming but somewhat feckless Scot who had made a considerable name for himself as a professional magician. His death at the early age of forty-five had been aggravated by the excessive consumption of his country's most famous product. Though Jan had never seen his father drunk, he was not sure that he had ever seen him sober.
Mrs. Rodricks, still very mt~çh alive, lectured in advanced probability theory at Edinburgh University. It was typical of the extreme mobility of twenty-first-century Man that Mrs. Rodricks, who was coal black, had been born in Scotland, whereas her expatriate and blond husband had spent almost all his life in Haiti.
Maia and Jan had never had a single home, but had oscillated between their parents' families like two small shuttlecocks. The treatment had been good fun, but had not helped to correct the instability they had both inherited from their father.
At twenty-seven, Jan still had several years of college life ahead of him before he needed to think seriously about his career. He had taken his bachelors' degrees without any difilculty, following a syllabus that would have seemed very strange a century before. Ilis main subjects bad been mathematics and physics, but as subsidiaries he had taken philosophy and

musical appreciation. Even by the high standards of the time he was a first-rate amateur pianist.
In three years he would take his doctorate in engineering physics, with astronomy as a second subject. This would involve fairly hard work, but Jan rather welcomed that. He was studying at what was perhaps the most beautifully situated place of higher education in the world-the University of Cape Town, nestling at the foot of Table Mountain.
He had no material worries, yet he was discontented and saw no cure for his condition. To make matters worse, Maia's own happiness-thotigh he did not grudge it in the least-had underlined the chief cause of his own trouble.
For Jan was still suffering from the romantic illusion-the cause of so much misery and so much poetry-that every man has only one real love in his life. At an unusually late age, be had lost his heart for the first time, to a lady more renowned for beauty than constancy. Rosita Tsien claimed, with perfect truth, to have the blood of Manchu emperors flowing in her veins. She still possessed many subjects, including most of the Faculty of Science at Cape. Jan had been taken prisoner by her delicate, flower-like beauty, and the affair had proceeded far enough to make its termination all the more galling. He could not imagine what had gone wrong....
He would get over it, of course. Other men had survived similar catastrophes without irreparable damage, had even reached the stage when they could say, "I'm sure I could never have been really serious about a woman like that!" But such detachment still lay far in the future, and at the moment Jan was very much at odds with life.
His other grievance was less easily remedied, for it concerned the impact of the Overlords upon his own ambitions. Jan was a romantic not only in heart but in mind. Like so many other young men since the conquest of the air had been

assured, he had let his dreams and his imagination roam the unexplored seas of space.
A century before, Man had set foot upon the ladder that could lead him to the stars. At that very moment-could it have been coincidence?-the door to the planets had been slammed in his face. The Overlords had imposed few positive bans on any form of human activity (the conduct of war was perhaps the major exception), but research into space flight had virtually ceased. The challenge presented by the science
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of the Overlords was too great. For the moment, at least, Man had lost heart and had turned to other fields of activity. There was no point in developing rockets when the Overlords had Infinitely superior means of propulsion, based on principles of which they had never given any hint.
A few hundred men had visited the moon, for the purpose of establishing a lunar observatory. They had travelled as passengers in a small vessel loaned by the Overlords-and driven by rockets. It was obvious that little could be learned from a study of this primitive vehicle, even if its owners handed it over without reservation to inquisitive terrestrial scientists.
Man was, therefore, still a prisoner on his wn planet. It was a much fairer, but a much smaller, planet than it had been a century before. When the Overlords had abolished war and hunger and disease, they had also abolished adventure.
The rising moon was beginning to paint the eastern sky with.
a pale milky glow. Up there, Jan knew, was the main base of the Overlords, lying within the ramparts of Pluto. Though the supply ships must have been coming and going for more than seventy years, it was only in Jan's lifetime that all concealment had been dropped and they had made their departure in clear sight of Earth. In the two-hundred-inch telescope, the shadows of the great ships could be dearly seen when the morning or evening sun cast them for miles across the lunar plains. Since everything that the Overlords did was of immense interest to mankind, a careful watch was kept of their comings and goings, and the pattern of their behaviour (though not the reason for it) was beginning to emerge. One of those great shadows had vanished a few hours ago. That meant, Jan knew, that somewhere off the moon an Overlord ship was lying in space, carrying out whatever routine was necessary before it began its journey to its distant, unknown home.
He had never seen one of those returning ships launch itself towards the stars. If conditions were good the sight was visible over half the world, but Jan had always been unlucky. One could never tell exactly when the take-off would be-and the Overlords did not advertise the fact. He decided he would wait another ten minutes, then rejoin the party.
What was that? Only a meteor sliding down through Eridanus. Jan relaxed, discovered his cigarette had gone out, and lit another.
He was half-way through it when, half a million kilometres
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away, the Stardrive went on. Up from the heart of the spreading moon-glow a tiny spark began to climb towards the zenith.
At first its movement was so slow that it could hardly be perceived, but second by second it was gaining speed. As it
climbed it increased in brilliance, then suddenly faded from sight. A moment later it had reappeared, gaining speed and brightness. Waxing and waning with a peculiar rhythm, it
ascended ever more swiftly into the sky, drawing a fluctuating
line of light across the stars. Even if one did not know its real distance, the impression of speed was breathtaking: when one knew that the departing ship was somewhere beyond the moon, the mind reeled at the speeds and energies involved.
It was an unimportant by-product of those energies, Jan knew, that he was seeing now. The ship itself was invisible, already far ahead of that ascending light.

As a high-flying jet may leave a vapour trail behind it, so the outward-bound vessel of the Overlords left its own peculiar wake. The generally accepted theory-and there seemed little doubt of its truth- was that the immense accelerations of the Stardrive caused a local distortion of space. What Jan was seeing, he knew, was nothing less than the light of distant stars, collected and focused into his eye wherever conditions were favourable along the track of the ship. It was a. visible proof of relativity-the bending of light in the presence of a colossal gravitational field.

Now the end of that vast, pencil-shaped lens seemed to be moving more slowly, but that was only due to perspective. In reality the ship was still gaining speed: its path was merely being foreshortened as it hurled itself outwards to the stars. There would be many telescopes following it, Jan knew, as Earth's scientists tried to uncover the secrets of the Drive. Dozens of papers had already been published on the subject; no doubt the Overlords had read them with the greatest interest.

The phantom light was beginning to wane. Now it was a fading streak, pointing to the heart of the constellation Carina, as Jan had known that it would. The home of the Overlords was somewhere out there, but it might circle any one of a thousand stars in that sector of space. There was no way of telling its distance from the Solar System.

It was all over. Though the ship had scarcely begun its Journey, there was nothing more that human eyes could see. But in Jan's mind the memory of that shining path still burned,

a beacon that would never fade as long as he possessed anibition and desire.

The parry was over. Almost all the guests had climbed back into the sky and were now scattering to the four corners of the globe. There were, however, a few exceptions.

One was Norman Dodsworth, the poet, who had got unpleasantly drunk but had been sensible enough to pass out befbre any violent action proved necessary. He had been deposited, not very gently, on the lawn, where it was hoped that a hyena would give him a rude awakening. For all practical purposes he could, therefore, be regarded as absent.

The other remaining guests were George and Jean. This was not George's idea at all: he wanted to go home. He disapproved of the friendship between Rupert and Jean, though not for the usual reason. George prided himself on being a practical, level-headed character, and regarded the interest which drew Jean and Rupert together as being not only childish in this age of science, but more than a little unhealthy. That anyone should still place the slightest credence in the supernormal seemed extraordinary to him, and finding Rashaverak here had shaken his faith in the Overlords.

It was now obvious that Rupert had been plotting some surprise, probably with Jean's connivance. George resigned himself gloomily to whatever nonsense was coming.

"I tried all sorts of things before I settled on this," said Rupert proudly. "The big problem is to reduce friction so that you get complete freedom of movement. The old-fashioned polished table and tumbler set-up isn't bad, but ft's been used for centuries now and I was sure that modern science could do better. And here's the result. Draw up your chairs- are you quite sure you don't want to join, Rashy?"

The Overlord seemed to hesitate for a fraction of a second. Then he shook his head. (Had they learned that habit on Earth? George wondered.)

"No, thank you," he replied. "I would prefer to observe. Some other time, perhaps."

"Very well-there's plenty of time to change your mind later."

Oh, Is there? thought George, looking gloomily at his watch.
Rupert had shepherded his friends round a small but massive
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table, perfectly circular in shape. It had a flat plastic top which he lifted off to reveal a glittering sea of closely packed ball-bearings. They were prevented from escaping by the table's slightly raised rim, and George found it quite impossible to imagine their purpose. The hundreds of reflected points of light formed a fascinating and hypnotic pattern, and he felt himself becoming slightly dizzy.
As they drew up their chairs, Rupert reached under the table and brought forth a disc some ten centimetres in diameter, which he placed on the surface of the ball-bearings.
"There you are," he said. "You put your fingers on this, and it moves around with no resistance at all."
George eyed the device with profound distrust. He noted that the letters of the alphabet were placed at regular intervals
-though in no particular order-round the circumference of the table. In addition there were the numbers one to nine, scattered at random among the letters, and two cards bearing the words "~s" and "NO". These were on opposite sides of the table.
"It looks like a lot of mumbo-jumbo to me," he muttered. "I'm surprised that anyone takes it seriously in this age." He felt a little better after delivering this mild protest, which was aimed at Jean quite as much as Rupert. Rupert didn't pretend to have more than a detached scientific interest in these phenomena. He was open-minded, but not credulous. Jean, on the other hand-well, George was sometimes a little worried about her. She really seemed to think that there was something in this business of telepathy and second-sight.
Not until he had made his remark did George realize that it also implied a criticism of Rashaverak. He glanced nervously round but the Overlord showed no reaction. Which, of course, proved absolutely nothing at all.
Everyone had now taken up their positions. Going in a clockwise direction round the table were Rupert, Maia, Jan, Jean, George, and Benny Shoenberger. Ruth Shoenberger was sitting outside the cirde with a notebook. She apparently had some objection to taking part in the proceedings, which had caused Benny to snake obscurely sarcastic remarks about people who still took the Talmud seriously. However, she seemed perfectly willing to act as a recorder.
"Now listen," began Rupert, "for the benefit of sceptics like George, let's get this straight. Whether or not there's
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anything supernormal about this, it works. Personally, I think there's a purely mechanical explanation. When we put our hands on the disc, even though we may try to avoid influencing its movements, our subconscious starts playing tricks. I've analysed lots of these seances, and I've never got answers that someone in the group mightn't have known or guessed- though sometimes they weren't aware of the fact. However, I'd like to carry out the experiment in these rather-ah-peculiar circumstances."
The Peculiar Circumstance sat watching them silently, but doubtless not with indifference. George wondered just what Rashaverak thought of these antics. Were his reactions those of an anthropologist watching some primitive religious rite? The whole set-up was really quite fantastic, and George felt as big a fool as he had ever done in his life.
If the others felt equally foolish, they concealed their emotions. Only Jean looked flushed and excited, though that night have been the drinks.
"All set?" asked Rupert. "Very well." He paused impressively; then, addressing no-one in particular, he called ~ut: "Is there anybody there?"
George could feel the plate beneath his fingers tremble ~lightly. That was not surprising, considering the pressure teing exerted upon it by the six people in

the circle. It ilithered around in a small figure-eight, then came to rest back at the centre.
"Is there anybody there?" repeated Rupert. In a more conversational tone of voice he added, "It's often ten or fifteen minutes before we get started. But sometimes-"
"Hush!" breathed Jean.
The plate was moving. It began to swing in a wide arc between the cards labelled "yEs" and "NO". With some difficulty, George suppressed a giggle. Just what would it prove, he wondered, if the answer was "NO"? He remembered the old joke: "There's nobody here but us chickens, Massa. .. ."
But the answer was "YES". The plate came swiftly back to the centre of the table. Somehow it now seemed alive, waiting fir the next question. Despite himself, George began to be impressed.
"Who are you?" asked Rupert.
There was no hesitation now as the letters were spelled out. The plate darted across the table like a sentient thing, moving

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so swiftly that George sometimes found it hard to keep his fingers in contact. He could swear that he was not contributing to its motion. Glancing quickly round the table, he could see nothing suspicious in the faces of his friends. They seemed as intent, and as expectant, as he himself~
"IAMALL" spelled the plate, and returned to its point of equilibrium.
"'I am all,'" repeated Rupert. "That's a typical reply. Evasive, yet stimulating. It probably means that there's nothing here except our combined minds." He paused for a moment, obviously deciding upon his next question. Then he addressed the air once more.
"Have you a message for anyone here?"
"No," replied the plate promptly.
Rupert looked around the table.
"It's up to us; sometimes it volunteers information, but this time we'll have to ask definite questions. Anyone like to start?"
"Will it rain tomorrow?" said George jestingly.
At once the plate began to swing back and forth in the YES-
NO line. -
"That's a silly question," reproved Rupert. "It's bound to be r2ining somewhere and to be dry somewhere else. Don't ask questions that have ambiguous answers."
George felt appropriately squashed. He decided to let someone else have the next turn.
"What is my favourite colour?" asked Maia.
"BLuE," came the prompt reply.
"That's quite correct."
"But it doesn't prove anything. At least three people here knew that," George pointed out.
"What's Ruth's favourite colour?" asked Benny.
"RED."
"Is that right, Ruth?"
The recorder looked up from her notebook.
"Yes, it is. But Benny knows that, and he's in the circle."
"I didn't know," retorted Benny.
"You darn well ought to-I've told you enough times."
"Subconscious memory," murmured Rupert. "That often happens. But can we have some more intelligent questions, please? Now that this has started so well, I don't want It to peter out."
Curiously enough, the very triviality of the phenomenon was

beginning to impress George. He was sure that there was no supernormal explanation; as Rupert had said, the plate was simply responding to their unconscious muscular movements.

But this fact in itself was surprising and impressive: he would never have believed that such precise, swift replies could have been obtained. Once he tried to see if he could influence the board by making it spell out his own name. He got the "G", but that was all: the rest was nonsense. It was virtually unpossible, he decided, for one person to take control without the remainder of the circle knowing it.

After half an hour, Ruth had taken down more than a dozen messages, some of them quite long ones. There were occasional spelling mistakes and curiosities of grammar, but they were few. Whatever the explanation, George was now convinced that he was not contributing consciously to the results. Several times, as a word was being spelt out, he had anticipated the next letter and hence the meaning of the message. And on each occasion the plate had gone in a quite unexpected direction and spelt something totally different. Sometimes, indeed -since there was no pause to indicate the end of one word and the beginning of the next-the entire message was meaningless until it was complete and Ruth had read it back.

The whole experience gave George an uncanny impression of being in contact with some purposeful, independent mind. And yet there was no conclusive proof one way or the other. The replies were so trivial, so ambiguous. What, for example, could one make of:

BELIEVEINMANNATURRISWITHYOU.

Yet sometimes there were suggestions of profound, even disturbing truths:

RIMEMBERMANISNOTALONENEARMANISCOUNTRYOFOTHERS.

But of course everyone knew that-though could one be sure that the message merely referred to the Overlords?

George was growing very sleepy. It was high time, he thought drowsily, that they headed for home. This was all very Intriguing, but it wasn't getting them anywhere and you could have too much of a good thing. He glanced around the table.

Benny looked as if he might be feeling the same way, Maia and Rupert both appeared slightly glazed, and Jean-well, she had been taking it too seriously all along. Her expression worried

George; it was almost as if she were afraid to stop-yet afraid to go on.

That left only Jan. George wondered what he thought of his brother-in-law's eccentricities. The young engineer had asked no questions, shown no surprise at any of the answers. He seemed to be studying the movement of the plate as if it was just another scientific phenomenon.

Rupert roused himself from the lethargy into which he appeared to have fallen. "Let's have one more question," he said, "then we'll call it a day. What about you, Jan? You've not asked anything."

Surprisingly, Jan never hesitated. It was as if he had made
his choice a long time ago and had been waiting for the opportunity. He glanced once at the impassive bulk of Rashaverak, then called out in a clear, steady voice:

"Which star is the Overlord's sun?"

Rupert checked a whistle of surprise. Maia and Benny showed no reaction at all. Jean had closed her eyes and seemed to be asleep. Rashaverak had leaned forward so that he could look down into the circle over Rupert's shoulder.

And the plate began to move.

When it came to rest again, there was a brief pause: then Ruth asked, in a puzzled voice:
"What does NGS 549672 mean?"
She got no reply, for at the same moment George called out anxiously:
"Give me a hand with Jean. I'm afraid she's fainted."

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"THIS man Boyce," said Karellen. "Tell me all about him." The Supervisor did not use those actual words, of course,
and the thoughts he really expressed were far more subtle. A human listener would have heard a short burst of rapidly modulated sound, not unlike a high-speed Morse sender in action. Though many samples of Overlord language had been recorded, they all defied analysis because of their extreme coinplexity. The speed of transmission made it certain that no Interpreter, even if he had mastered the elements of the

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language, could ever keep up with the Overlords in their normal conversation.
The Supervisor for Earth stood with his back to Rashaverak,
staring out across the multicoloured gulf of the Grand Canyon.
Ten kilometres away, yet scarcely veiled by distance, the terraced walls were catching the full force of the sun. Hundreds of metres down the shadowed slope at whose brim Karellen stood, a mule-train was slowly winding its way into the valley's depths. It was strange, Karellen thought, that so many human beings still seized every opportunity for primitive behaviour. They could reach the bottom of the canyon in $ fraction of the time, and in far greater comfort, if they chose. Yet they preferred to be jolted along tracks which were probably as unsafe as they looked.
Karellen made an imperceptible gesture with his hand. The great panorama faded from view, leaving only a shadowy blankness of indeterminable depth. The realities of his office and of his position crowded in upon the Supervisor once more.
"Rupert Boyce is a somewhat curious character," Rashaverak answered.
"Professionally, he's in charge of animal welfare over an important section of the Main African ReservaLion. He's quite efficient, and interested in his work. Because he has to keep watch over several thousand square kilometres, he has one of the fifteen panoramic viewers we've so far issued cm loan-with the usual safeguards, of course. It is, incidentilly, the only one with full projection facilities. He was able to make a good case for these, so we let him have them."
"What was his argument?"
"He wanted to appear to various wild animals so that they could get used to seeing him, and so wouldn't attack when he was physically present. The theory has worked out quite well with ~nirna1s that rely on sight rather than smell-though he'll probably get killed eventually. And, of course, there was an)ther reason why we let him have the apparatus."
"It made him more co-operative?"
"Precisely. I originally contacted him because he has one rf the world's finest libraries of books on parapsychology and illied subjects. He politely but firmly refused to lend any of them, so there was nothing to do but to~it him. I've now read ibout half his library. It has been a considerable ordeal."
"That I can well believe," said Kardllen dryly. "Have you fiscovered anything among all the rubbish?"

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"Yes-eleven dear cases of partial breakthrough, and twenty-seven probables. The material is so selective, however, that one cannot use it for sampling purposes.

And the evidence is hopelessly confused with mysticism-perhaps the prime aberration of the human mind."
"And what is Boyce's attitude to all this?"
"He pretends to be open-minded and sceptical, but it's
clear that he would never have spent so much time and effort in this field unless he had some subconscious faith. I challenged him on this and he admitted that I was probably right.
He would like to find some convincing proof. That is why he Is always carrying out these experiments, even though he pretends that they are only gaines."
"You are sure he doesn't suspect that your interest is more than academic?"
"Quite sure. In many ways Boyce is remarkably obtuse and simple-minded. That makes his attempts to do research in this, of all fields, rather pathetic. There is no need to take any special acon regarding him."
"I see. And what about the girl who fainted?"
"This is the most exciting feature of the entire affair. Jean Morrel was, almost certainly, the channel through which the information came. But she is twenty-six-far too old to be a prime contact herself, judging by all our previous experience. It must, therefore, be someone closely linked to her. The conclusion is obvious. We cannot have many more years to wait. We must transfer her to Category Purple: she may be the most important human being alive."
"I will do that. And what of the young man who asked the question? Was it random curiosity, or did he have some other motive?"
"It was chance that brought him there-his sister has just married Rupert Boyce. He had never met any of the other guests before. I am sure the question was unpremeditated, being inspired by the unusual conditions-and probably by my presence. Given these factors, it is hardly surprising that he acted in the way he did. His great interest is astronautics:
he is secretary of the space-travel group at Cape Town University, and obviously intends to make this field his life study."
"Flis career should be interesting. Meanwhile, what action do you think he will take, and what shall we do about him?"

"lie will undoubtedly make some checks as soon as he can.
But there is no way in which he can prove the accuracy of his information, and because of its peculiar origin he is hardly likely to publish it. Even if he does, will it affect matters in the slightest?"
"I will have both situations evaluated," Karellen replied. "Though it is part of our Directive not to reveal our base, there is no way in which the information could be used against us."
"I agree. Rodricks will have some information which is of doubtful truth, and of no practical value."
"So it would seem," said Karellen. "But let us not be too certain. Human beings are remarkably ingenious, and often very persistent. It is never safe to underrate them, and it will be interesting to follow Mr. Rodricks' career. I must think about this further."

Rupert Boyce never really got to the bottom of it. When his guests had departed, rather less boisterously than usual, he bad thoughtfully rolled the table back into its corner. The mild alcoholic fog prevented any profound analysis of what had happened, and even the actual facts were already slightly blurred. He had a vague idea that something of great but elusive importance had happened, and wondered if he should 3iscuss it with Rashaverak. On second thought, he decided it aught be tactless. After all, his brother-in-law had caused the trouble, and Rupert felt vaguely annoyed with young Jan. But was it Jan's fault? Was it anybody's fault? Rather guiltily, Rupert remembered that it had been his experiment. He lecided, fairly successfully, to forget the whole business.

Perhaps he might have done something if the last page of Ruth's notebook could have been found, but it had vanished in the confusion. Jan always feigned innocence-and, well, one ould hardly accuse Rashaverak. And no-one could ever ~emember exactly what had been spelled out, except that it lidn't seem to make any sense.

The person most immediately affected had been George C~reggson. He could never forget his feeling of terror as Jean iitched into his arms. Her sudden helplessness transformed icr in that moment from an amusing companion to an object

of tenderness and affection. Women had fainted-not always without forethought-since time immemorial, and men had invariably responded in the desired way. Jean's collapse was completely spontaneous, but it could not ~have been better planned. In that instant, as he realized later, George came to one of the most important decisions of his life. Jean was definitely the girl who mattered, despite berqueer ideas and queerer friends. He had no intention of totally abandoning Naomi or Joy or Elsa or-what was her name?-Denise; but the tune bad come for something more permanent. He had no doubt that Jean would agree with him, for her feelings had been quite obvious from the start.

Behind his decision there was another factor of which, he was unaware. Tonight's experience had weakened his con-tempt and scepticism for Jean's peculiar interests. He would never recognize the fact, but it was so-and it had removed the last barrier between them.

He looked at Jean as she lay, pale but composed, in the reclining chair of the flyer. There was darkness below, stars above. George had no idea, to within a thousand kilometres, where they might be-nor did he care. That was the business of the robot that was guiding them homewards and would land them in, so the control board announced, fifty-seven minutes from now.

Jean smiled back at him and gently dislodged her hand from his.

"Just let me restore the circulation," she pleaded, rubbing her fingers. "I wish you'd believe me when I tell you I'm perfectly all right now."

"Then what do you think happened? Surely you remember sometFth~g?"

"No-it's just a complete blank. I heard Jan ask his quesdon-and then you were all making a fuss over me. I'm sure it was some kind of trance. After all-"

She paused, then decided not to tell George that this sort of thing had happened before. She knew how he felt about these matters, and had no desire to upset him further-and perhaps scare him away completely.

"After all-what?" asked George.

"Oh, nothing. I wonder what that Overlord thought about the whole business. We probably gave him more material than he bargained for."

Jean shivered slightly, and her eyes clouded.

"I'm afraid of the Overlords, George. Oh, I don't xne~ they're evil, or anything foolish like that. I'm sure they mean well and are doing what they think is best for us. I wonder just what their plans really are?"

George shifted uncomfortably.

"Men have been wondering that ever since they came to Earth," he said. "They'll tell us when we're ready for it-and, frankly, I'm not inquisitive. Besides, I've got more import~t things to bother about." He turned towards Jean and grasped her hands.

"What about going to Archives tomorrow and signing a contract for-let's say-five years?"

Jean looked at him steadfastly, and decided that, ~ the whole, she liked what she saw.

"Make it ten," she said.

Jan bided his time. There was no hurry, and he wanterj to think. It was almost as if he feared to make any checks, lest the fantastic hope that had come into his mind be too swiftly destroyed. While he was still uncertain, he could at least dream.

Moreover, to take any further action he would have to see the Observatory librarian. She knew hint and his interests too well, and would certainly be intrigued by his request. Probably it would make no difference, but Jan was determined to leave nothing to chance. There would be a better opportu~jty in a week. He was being super-cautious, he knew, but that added a schoolboy zest to the enterprise. Jan also feared ridicule quite as much as anything that the Overlords might Conceivably do to thwart him. If he was embarking on a wild-goose chase, no-one else would ever know.

He had a perfectly good reason for going to London: the arrangements had been made weeks ago. Though he wa~ too young and too unqualified to be a delegate, he was one of the three students who had nl2nllged to attach themselves to the official party going to the meeting of the International Astr~..

nomical Union. The vacancies had been there, and it scen~ed a pity to waste the opportunity, as he had not visited London since his childhood. He knew that very few of the dozens of papers to be delivered to the I.A.U. would be of the

interest to turn, even if he could understand them. Like a delegate to any scientific congress, he would attend the lectures that looked promising, and spend the rest of the time talking with fellow enthusiasts, or simply sightseeing.

London had changed enormously in the last fifty years. It now contained scarcely two million people, and a hundred times as many machines. It was no longer a great port, for with every country producing almost all its needs, the entire pattern of world trade had been altered. There were some goods that certain countries still made best, but they went directly by air to their destinations. The trade routes that had once converged on the great harbours, and later on the great airports, had finally dispersed into an intricate web-work covering the whole world with no major nodal points.

Yet some things had not altered. The city was still a centre of administration, of art, of learning. In these matters, none of the continental capitals could rival it-not even Paris, despite many claims to the contrary. A Londoner from a century before could still have found his way around, at least at the city's centre, with no difficulty. There were new bridges over the Thames, but in the old places. The great, grimy railway stations had gone-banished to the suburbs. But the Houses of Parliament were unchanged: Nelson's solitary eye still stared down Whitehall: the dome of St. Paul's still stood above Ludgate Hill, though now there were taller buildings to challenge its pre-eminence.

And the guard still marched in front of Buckingham Palace.

All these things, thought Jan, could wait. It was vacation time, and he was lodged, with his two fellow students, in one of the University hostels. Blooinsbury also had not changed its character in the last century: it was still an island of hotels and boarding-houses, though they no longer jostled each other so closely, or formed such endless, identical rows of soot-coated brick.

It was not until the second day of the Congress that Jan got his opportunity. The main papers were being read in the great assembly chamber of the Science Centre, not far from the Concert Hall that had done so much to make London the musical metropolis of the world. Jan wanted to hear the first of the day's

lectures, which, it was rumoured, would completely demolish the current theory of the formation of the planets.
Perhaps it did, but Jan was little the wiser when he left after
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the interval. He hurried down to the directory, and looked up the rooms he wanted.
Some humorous civil servant had put the Royal Astrociomical Society on the top floor of the great building, a gesture which the Council members fully appreciated as it gave them a magnificent view across the l'hames and over the entire north~rn part of the city. There seemed to be nobody around, but ~an-duching his membership card like a passport in case he was challenged-had no difficulty in locating the library.
It took him almost an hour to find what he wanted, and to learn how to handle the great star catalogues with their millions of entries. He was trembling slightly as he neared the end of his quest, and felt glad that there was no-one around to see his nervousness.
He put the catalogue back among its fellows, and for a long time sat quite still, staring sightlessly at the wall of volumes before him. Then he slowly walked Out into the still corridors, past the secretary's office (there was somebody there now, busily unpacking parcels of books) and down the stairs. He avoided the elevator, for he wanted to be free and unconfined.
There was another lecture he had intended to hear, but that was nO longer important now.
His thoughts were still in turmoil as he crossed to the embankment wall and let his eye follow the Thames on its unhurried way to the sea. It was hard for anyone with his training in orthodox science to accept the evidence that had now come into his hands. He would never be certain of its truth, yet the probability was overwhelming. As he paced slowly beside the river wall, he marshalled the facts one by one.
Fact one: no-one at Rupert's party could possibly have known that he was going to ask that question. He had not known it himself: it had been a spontaneous reaction to the circumstances. Therefore, no-one could have prepared any answer, or had it already lying in their minds.
Fact two: "NGS 549672" probably meant nothing to anyone except an astronomer. Though the great National Geographic Survey had been completed half a century before, its existence was known only to a few thousand specialists. And taking any number from it at random, no-one could have said where that particular star lay in the heavens.
But-and this was Fact three, which he had only this moment discovered-the small and insignificant star known as
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NGS 549672 was in precisely the right place. It lay in the heart of the constellation Carina, at the end of that shining trail Jan himseLf had seen, so few nights ago, leading from the Solar System out across the depths of space.
It was an impossible coincidence. NGS 549672 must be the home of the Overlords.
Yet to accept the fact violated all Jan's cherished ideas of scientific method.
Very well-let them be violated. He must accept the fact that, somehow, Rupert's fantastic experiment had tapped a hitherto unknown source of knowledge.
Rashaverak? That seemed the most probable explanation. The Overlord had not been in the circle, but that was a minor point. However, Jan was not concerned with the mechanism of paraphysics: he was only interested in using the results.
Very little was know about NGS 549672: there had been nothing to distinguish it from a million other stars. But the catalogue gave its magnitude, its co-ordinates, and its spectral type. Jan would have to do a little research, and make a few simple calculations: then he would know, at least approximately, how far the world of the Overlords was from Earth.

A slow smile spread over Jan's face as he turned away from the Thames, back towards the gleaming white façade of the Science Centre. Knowledge was power-and he was the only man on Earth who knew the origin of the Overlords. How he would use that knowledge he could not guess. It would lie safely in his mind, awaiting the moment of destiny.

10

Tw~ human race continued to bask in the long, cloudless summei afternoon of peace and prosperity. Would there ever be a winter again? It was unthinkable. The age of reason, prematurely welcomed by the leaders of the French Revolution two and a half centuries before, had now really arrived. This time, there was no mistake.

There were drawbacks, of course, though they were willingly accepted. One had to be very old indeed to realize that the papers which the telecaster printed in every home were really rather dull. Gone were the crises that had once produced banner headlines. There were no mysterious murders to

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baffle the police and to arouse in a million breasts the moral indignation that was often suppressed envy. Such murders as

did occur were never mysterious: it was only necessary to turn a dial-and the crime could be seen re-enacted. That instruments capable of such feats existed had at first caused considerable panic among quite law-abiding people. This was something that the Overlords, who had mastered most but not all the quirks of human psychology, had not anticipated. It had to be made perfectly clear that no Peeping Tom would be able to spy on his fellows, and that the very few instruments in human hands would be under strict control. Rupert Boyce's projector, for instance, could not operate beyond the borders of the Reservation, so he and Main were the only persons inside its range.

Even the few serious crimes that did occur received no par..

ricular attention in the news. For well-bred people do not, after all, care to read about the social gaffes of others.

The average working week was now about twenty hours- but those twenty hours were no sinecure. There was little work left of a routine, mechanical nature. Men's minds were too valuable to waste on tasks that a few thousand transistors, some photoelectric cells, and a cubic metre of printed circuits could perform. There were factories that ran for weeks without being visited by a single human being. Men were needed for trouble-shooting, for making decisions, for planning new enterprises. The robots did the rest.

The existence of so much leisure would have created tremendous problems a century before. Education had overcome most of these, for a well-stocked mind is safe from boredom. The general standard of culture was at a level which would once have seemed fantastic. There was no evidence that the intelligence of the human race had improved, but for the first time everyone was given the fullest opportunity of using what brains they had.

Most people had two homes, in widely separated parts of the world. Now that the polar regions had been opened up, a considerable fraction of the human race oscillated from Arctic to Antarctic at six monthly intervals, seeking the long, nightiess polar summer. Others bad gone into the deserts, up the mountains, or even into the sea. There was nowhere on the planet where science and technology could not provide one with a comfortable home, if one wanted it badly enough.

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Some of the more eccentric dwelling-places provided the few items of excitement in the news. In the most perfectly ordered-society there will always be accidents. Perhaps it was a good sign that people felt it worthwhile to risk, and occasionally break, their necks for the sake of a cosy villa tucked under

the summit of Everest, or looking out through the spray of Victoria Falls. As a result, someone was always being rescued from somewhere. It had become a kind of game-almost a planetary sport.
People could indulge in such whims, because they had both the time and the money. The abolition of armed forces had at once almost doubled the world's effective wealth, and increased production had done the rest. As a result, it was difficult to compare the standard of living of twenty-first-century man with that of any of his predecessors. Everything was so cheap that the necessities of life were free, provided as a public service by the community as roads, water, street lighting and drainage had once been. A man could travel anywhere he pleased, eat whatever food he fancied-without handing over any money. He had earned the right to do this by being a productive member of the community.
There were, of course, some drones, but the number of people sufficiently strong-willed to indulge in a life of complete idleness is much smaller than is generally supposed. Supporting such parasites was considerably less of a burden than providing the armies of ticket-collectors, shop assistants, bank clerks, stockbrokers and so forth whose main function, when one took the global point of view, was to transfer items from one ledger to another.
Nearly a quarter of the human race's total activity, it had been calculated, was now expended on sports of various kinds, ranging from such sedentary occupations as chess to lethal pursuits like ski-gliding across mountain valleys. One unexpected result of this was the extinction of the professional sportsmen. There were too many brilliant amateurs, and the changed economic conditions had made the old system obsolete.
Next to sport, entertainment, in all its branches, was the greatest single industry. For more than a hundred years there had been people who had believed that Hollywood was the centre of the world. They could now make a better case for this claim than ever before, but it was safe to say that most of

2050's productions would have seemed incomprehensibly highbrow to 1950. There had been some progress: the box-office was no longer lord of all it surveyed.
Among all the distractions and diversions of a planet which'~.
now seemed well on the way to becoming one vast playground, there were some who still found time to repeat an ancient and never-answered question:
"Where do we go from here?"

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Jail leaned against the elephant and rested his hands on the skin, rough as the bark of a tree. He looked at the great tusks and the curving trunk, caught by the skill of the taxidermist in the moment of challenge or salutation. What still weirder creatures, he wondered, from what unknown worlds would one day be looking at this exile from Earth?
"How many animals have you sent the Overlords?" he asked Rupert.
"At least fifty, though of course this is the biggest one. He's magnificent, isn't he? Most of the others have been quite small-butterflies, snakes, monkeys, and so on. Though I did get a hippo last year."
Jan gave a wry smile.
"It's a morbid thought, but I suppose they've got a fine stuffed group of Homo sapiens in their collection by this time. I wonder who was honoured?"
"You're probably right," said Rupert, rather indifferently. "It would be easy to arrange through the hospitals."
"What would happen," continued Jan thoughtfully, "if someone volunteered to go as a live specimen? Assuming that an eventual return was guaranteed, of course."
Rupert laughed, though not unsympathetically.

"Is that an offer? Shall I put it to Rashaverak?"
For a moment Jan considered the idea more than half seriously. Then he shook his head.
"Er-no. I was only thinking out loud. They'd certainly turn me down. By the way, do you ever see Rashaverak these days?"
"He called me up about six weeks ago. He'd just foun4a book I'd been hunting. Rather nice of him."
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Jan walked slowly round the stuffed monster, admiring the skill that had frozen it forever at this instant of greatest vigour.
"Did you ever discover what he was looking for?" he asked.
"I mean, it seems so hard to reconcile the Overlords' science with an interest in the occult."
Rupert looked at Jan a little suspiciously, wondering if his brother-in-law was poking fun at his hobby.
"His explanation seemed adequate. As an anthropologist he was interested in every aspect of our culture. Remember, they have plenty of time. They can go into more detail than a human research worker ever could. Reading my entire library probably put only a slight strain on Rashy's resources."
That might be the answer, but Jan was not convinced.
Sometimes he had thought of confiding his secret to Rupert but his natural caution had held him back. When he met his Overlord friend again, Rupert would probably give something away-the temptation would be far too great.
"Incidentally," said Rupert, changing the subject abruptly, "if you think this is a big job, you should see the commission Sullivan's got. He's promised to deliver the two biggest creatures of all-a sperm whale and a giant squid. They'll be shown locked in mortal combat. What a tableau that will make!"
For a moment Jan did not answer. The idea that had exploded in his mind was too outrageous, too fantastic to be taken seriously. Yet, because of its very daring, it might succeed.
"What's the matter?" said Rupert anxiously. "The heat getting you down?"
Jan shook himself back to present reality.
"I'm all tight," he said. "I was just wondering how the Overlords would collect a little packet like that."
"oh," said Rupert, "one of those cargo ships of theirs will come down, open a hatch, and hoist it in."
"That," said Jan, "is exactly what I thought.'

It might have been the cabin of a spaceship, but it was not. The walls were covered with meters and instruments: there were no windows-merely a large screen in front of the pilot. The vessel could carry six passengers, but at the moment Jan was the only one.
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He was watching the screen intently, absorbing each glimpse of this strange and unknown region as it passed before his eyes. Unknown-yes, as unknown as anything he might meet beyond the stars, ifhis mad plan succeeded. He was going into a realm of nightmare creatures, preying upon each other in a darkness undisturbed since the world began. It was a realm above which men had sailed for thousands of years: it lay no more than a kilometre below the keels of their ships-yet until the last hundred years they had known less about it than the visible face of the moon.
The pilot was dropping down from the ocean heights, towards the still unexplored vastness of the South Pacific Basin. He was following, Jan knew, the invisible grid of sound waves created by beacons along the ocean floor. They were still sailing as far above that floor as clouds above the surface of the Earth....

There was very little to see: the submarine's scanners were searching the waters in vain. The disturbance created by their jets had probably scared away the smaller fish: if any creature came to investigate, it would be something so large that it did not know the meaning of fear.
The tiny cabin vibrated with power-the power which could hold at bay the immense weight of the waters above their heads, and could create this little bubble of light and air within which men could live. If that power failed, thought Jan, they would become prisoners in a metal tomb, buried deep in the silt of the ocean bed.
"Time to get a fix," said the pilot. He threw a set of switches, and the submarine came to rest in a gentle surge of deceleraion as the jets ceased their thrust. The vessel wasinotioniess, ~oating in equilibrium as a balloon floats in the atmosphere.
It took only a moment to check their position on the sonar ~rid. When he had finished with his instrument readings, the pilot remarked: "Before we start the motors again, let's see if we can hear anything."
The loudspeaker flooded the quiet little room with a low, ~ontinuous murmur of sound. There was no outstanding ioise that Jan could distinguish from the rest. It was a steady Dackground, into which all individual sounds had been Diended. He was listening, Jan knew, to the myriad creatures)f the sea talking together. It was as if he stood in the centre)f a forest that teemed with life-except that there he would

have recognized some of the individual voices. Here, not one thread in the tapestry of sound could be disentangled and identified. It was so alien, so remote from anything he had ever known, that it set Jan's scalp crawling. And yet this was part of his own world- The shriek cut across the vibrating background like a flash
of lightning against a dark stormdoud. It faded swiftly away Into a banshee wail, an ululation that dwindled and died, yet was repeated a moment later from a more distant source. Then a chorus of screams broke out, a pandemonium that caused the pilot to reach swiftly for the volume control.
'What in the name of God was that?" gasped Jan.
"Weird, isn't it? It's a school of whales, about ten kilo-metres away. I knew they were in the neighbourhood and thought you'd like to hear them."
Jan shuddered.
"And I always thought the sea was silent! Why do they make such a din?"
"Talking to one another, I suppose. Sullivan could tell you
-they say he can even identifS' some individual whales, though I find that hard to believe. Hello, we've got company!"
A fish with incredibly exaggerated jaws was visible in the viewing screen. It appeared to be quite large, but as Jan did now know the scale of the picture it was bard to judge. Hanging from a point just below its gills was a long tendril, ending In an unidentifiable, bell-shaped organ.
"We're seeing it on infra-red," said the pilot. "Let's look at the normal picture."
The fish vanished completely. Only the pendant remained,

slowing with its own phosphorescence. Then, just for an mstant, the shape of the creature ifickered into visibility as a line of lights flashed out along its body.
"It's an angler: that's the bait it uses to lure other fish. Fantastic, Isn't it? What I don't understand is-why doesn't his bait attract fish big enough to eat him? But we can't wait here all day. Watch him run when I switch on the jets."

The cabin vibrated once again as the vessel eased itself forward. The great luminous fish suddenly flashed on all its lights in a frantic signal of alarm, and departed like a meteor Into the darkness of the abyss.

It was after another twenty minutes of slow descent that the Invisible fingers of the scanner beams caught the first

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glimpse of the ocean bed. Far beneath, a range of low hills was passing, their outlines curiously soft and rounded. What-~ ever irregularities they might once have possessed had long ago been obliterated by the ceaseless rain from the watery heights above. Even here in mid-Pacific, far from the great estuaries that slowly swept the continents out to sea, that rain never ceased. It came from the storm-scarred flanks of the Andes, ~J from the bodies of a billion living creatures, from the dust of~i meteors that had wandered through space for ages and had come at last to rest. Here in the eternal night, it was laying the foundations of the lands to be.

The hills drifted behind. They were the frontier posts, as Jan could see from the charts, of a wide plain which lay at too great a depth for the scanners to reach.

The submarine continued on its gentle downward glide. Now another picture was beginning to form on the screen:

because of the angle of view, it was some tune before Jan could interpret what he saw. Then he realized that they were approaching a submerged mountain, jutting up from the hidden plain.

The picture was dearer now: at this short range the definition of the scanners improved and the view was almost as distinct as if the image was being formed by light-waves. Jan could see fine detail, could watch the strange fish that pursued each other among the rocks. Once a venomous-looking creature with gaping jaws swam slowly across a half-concealed cleft. So swiftly that the eye could not follow the movement, a long tentacle flashed out and dragged the struggling fish down to its doom.

"Nearly there,".said the pilot. "You'll be able to see the lab in a minute."

They were travelling slowly above a spur of rock jutting out from the base of the mountain. The plain beneath was now coming into view: Jan guessed that they were not more than a few hundred metres above the sea-bed. Then he saw, a kilometre or so ahead, a cluster of spheres standing on tripod legs, and joined together by connecting tubes. It looked exactly like the tanks of some chemical plant, and indeed was designed on the same basic principles. The only difference was that here the pressures which had to be resisted were outside, not within.

"What's that?" gasped Jan suddenly. He pointed a shaky

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finger towards -the nearest sphere. The curious pattern of lines on its surftce had resolved itself into a network of giant tentacles. As the submarine came closer, he could see that they ended in a great, pulpy bag, from which peered a pair of enormous eyes.

"That," said the pilot indifferently, "is probably Lucifer. Someone's been feeding him again." He threw a switch and leaned over the control desk.

"S.2 calling Lab. I'm connecting up. Will you shoo away your pet?"

The reply came promptly.

"Lab to S.2. O.K.-go ahead and make contact. Lucey will get out of the way."

The curving metal walls began to fill the screen. Jan caught a last glimpse of a giant, sucker-studded arm whipping away at their approach. Then there was a dull clang, and a series of scratching noises as the clamps sought for their locking points on the submarine's smooth, oval hull. In a few minutes the vessel was pressed tightly against the wall of the base, the two entrance ports had locked together, and were moving forward through the hull of the submarine at the end of a giant hollow screw. Then came the "pressure equalized" signal, the batches unsealed, and the way into Deep Sea Lab One was open.

Jan found Professor Sullivan in a small, untidy room that seemed to combine the attributes of office, workshop and laboratory. He was peeping through a microscope into what looked like a small bomb. Presumably it was a pressure-capsule containing some specimen of deep-sea life, still swimming happily around under its normal tons-to-the-square-centimetre conditions.

'Well," said Sullivan, dragging himself away from the eyepiece. "How's Rupert? And what can we do for you?"

"Rupert's fine," replied Jan. "He sends his best wishes, and says he'd love to visit you if it weren't for his claustrophobia."

"Then he'd certainly feel a little unhappy down here, with five kilometres of water on top of him. Doesn't it worry you, by the way?"

Jan shrugged his shoulders.

"No more than being in a stratoliner. If anything went wrong, the result would be the same in either case."

"That's the sensible approach, but it's surprising how few

people see it that way." Sullivan toyed with the controls of his microscope, then shot Jan an inquisitive glance.

"I'll be very glad to show you around," he said, "but I must confess I was a little surprised when Rupert passed on your request. I couldn't understand why one of you spacehounds~. should be interested in our work. Aren't you going in the wrong direction?" He gave a chuckle of amusement. "Personally, I've never seen why you were in such a hurry to get~ out there. It will be centuries before we've got everything ln~ the oceans nicely charted and pigeonholed."

Jan took a deep breath. He was glad that Sullivan had .~, broached the subject himself; fbr it made his task that much easier. Despite the ichthyologist's jest, they had a great deal in common. It should not be too hard to build a bridge, to enlist Sullivan's sympathy and aid. He was a man of imagination, or he would never have invaded this underwater world. But Jan would have to be cautious, for the request he was going to make was, to say the least of it, somewhat unconventional.

There was one fact that gave him confidence. Even if Sullivan refused to co-operate, he would certainly keep Jan's secret. And here in this quiet little office on thc bed of the Pacific, there seemed no danger that the Overlords-whatever strange powers they possessed-would be able to listen to their conversation.

"Professor Sullivan," he began, "if you were interested in the ocean, but the Overlords refused to let you go near it, how would you feel?"

"Exceedingly annoyed, no doubt."

"I'm sure you would. And suppose, one day, you had a chance of achieving your goal, without them knowing, what would you do? Would you take the opportunity?"

Sullivan never hesitated.

"Of course. And argue later."

Right into my hsnds~ thought Jan. He can't retreat now- unless he's afraid of the Overlords. And I doubt if Sullivan is afraid of anything. He leaned forward across the cluttered table and prepared to present his case.

Professor Sullivan was no fool. Before Jan could speak, his lips twisted into a sardonic smile.

"So that's the game, is it?" he said slowly. "Very, very Interesting! Now you go right ahead and tell me why I should help you-"

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earlier age would have regarded Professor Suffivan as an expensive luxury. His operations cost as much as a small war: indeed, he could be likened to a general conducting a perpetual campaign against an enemy who never relaxed. Professor Sullivan's enemy waS the sea, and it

fought him with weapons of cold and darkness-and, above all, pressure. In his turn, he countered his adversary with intelligence and engineering skill. He bad won many victories, but the sea was patient: it could wait. One day, Sullivan knew, he would make a mistake.
At least he had the consolation of knowing that he could never drown. It would be far too quick for that
He had refused to commit himself one way or the other when Jan made his request, but he knew what his answer was going to be. Here was the opportunity for a most interesting experiment. It was a pity that he would never know the result; still, that happened often enough in scientific research, and he had initiatedother programmes thatwould take decades to complete.
Professor Sullivan was a brave and an intelligent man, but looking back on his career he was conscious of the fact that it had not brought him the sort of fame that sends a scientist's name safely down all the centuries. Here was a chance, totally unexpected and all the more attractive for that, of really establishing himself in the history books. It was not an ambition he would ever have admitted to anybody-and, to do him justice, he would still have helped Jan even if his part in the plot remained forever secret

As for Jan, he was now having second thoughts. The momentum of his original discovery had carried him thus far almost without effort. He had made his investigations, but had taken no active steps to turn his dream into reality. In $ few days, however, he must make his choice. If Professor Sullivan agreed to co-operate, there was no way in which he could retreat. He must face the future he had chosen, with all its Implications.
What finally decided him was the thought that, If he neglected this incredible opportunity, he would never forgive himself. All the rest of his life would be spent in vain regrets- and nothing could be worse than that.

Sullivan's answer reached him a few hours later, and he knew that the die was cast. Slowly, because there was still plenty of time, he began to put his affairs in order.

"Dear Maia [the letter began]. This is going to be-to put it mildly-rather a surprise for you. When you get this letter, I shall no longer be on Earth. By that I don't mean that I shall have gone to theMoon, as many others have done. No: I shall be on my way to the home of the Overlords. I shall be the ~rst man ever to leave the Solar System.
"I am giving this letter to the friend who is helping me: he will hold it until he knows that my plan has succeeded-in its first phase, at least-and that it is too late for the Overlords to interfere. I shall be so far away, and travelling at such a speed, that I doubt if any recall message can overtake me. Even if it could, it seems most unlikely that the ship would be able to put back to Earth. And I very much doubt if I'm all that important, anyway.
"First, let me explain what led to this. You know that I've always been interested in spaceflight, and have always felt frustrated because we've never been allowed to go to the other planets, or to learn anything about the civilization of the Overlords. If they had never intervened, we might have reached Mars and Venus by now. I admit that it is equally probable that we would have destroyed ourselves with coli~alt bombs and the other global weapons the twentieth century was developing. Yet sometimes I wish we could have had a chance of standing on our own feet.
"Probably the Overlords have their reasons for keeping us in the nursery, and probably they are excellent reasons. But even if! knew what they were, I doubt if it would make much difference to my own feelings-or my actions.

"Everything really began at that party of Rupert's. (He doesn't know about this, by the way, though he put me on the right track.) You remember that silly séance he arranged and how it ended when that girl-I forget her name-fainted? I'd asked what star the Overlords came from, and tne reply was 'NGS 549672.' I'd not expected any answer, and had treated the whole business as a joke until then. But when I realized that this was a number in a star catalogue, I decided to look into it. I found that the star was in the constellation Carina- 106
and one of the few facts that we do know about the Overlords is that they come from that dire~*ion.

"Now I don't pretend to understand how that information reached us, or where it originated. Did someone read Rashaverak's mind? Even if they had, it's hardly likely that he would have known the reference number of his sun in one of our catalogues. It's a complete mystery, and I leave it to people like Rupert to solve-if they can! I'm just content to take the information, and to act on it.

"We know a lot now, through our observation of their departure, about the speed of the Overlord ships. They leave the Solar System under such tremendous accelerations that they approach the velocity of light in less than an hour. That means that the Overlords must possess some kind of propulsive system that acts equally on every atom of their ships, so that anything aboard won't be crushed instantly. I wonder why they employ such colossal accelerations, when they've got all space to play with and could take their time picking up speed? My theory is that they can somehow tap the energy fields round the stars, and so have to do their starting and stopping while they're fairly close to a sun. But that's all by the way....

"The important fact was that I knew how far they had to travel, and therefore how long the journey took. NGS 549672 is forty light-years from Earth. The Overlords ships reach more than ninety-nine per cent of the speed of light, so the trip must last forty years of our dine. Our time: that's the crux of the matter.

"Now as you may have beard, strange things happen as one approaches the speed of light. Time itself begins to flow at a different rate-to pass more slowly, so that what would be months on Earth would be no more than days on the ships of the Overlords. The effect is quite fundamental: it was discovered by the great Einstein more than a hundred years ago.

"I have made calculations based on what we know about the Stardrive, and using the firmly-established results of Relativity theory. From the viewpoint of the passengers on one of the Overlord ships, the journey to NGS 549672 will last not more than two months-even thou~h by Earth's reckoning forty years will have passed. I know this seems a paradox, and if it's any consolation it's puzzled the world's best brains ever since Einstein announced it.

"Perhaps this example will show you the sort of thing that
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can happen, and will give you a clearer picture of the situation. If the Overlords send me straight back to Earth, I shall arrive home having aged only four months. But on Earth itself; eighty years will have passed. So you understand, Maia, that whatever happens, this is goodbye.

"I have few ties binding me here, as you know well enough,
so I can leave with a clear conscience. I've not told mother yet:
she would get hysterical, and I couldn't face that. It's better this way. Though I've tried to make allowances, ever since father died-oh, there's no point now in going into all that again!

"I've terminated my studies and told the authorities that, for family reasons, I'm moving to Europe. Everything has been settled and there should be nothing for you to worry about.

"By this time, you may imagine that I'm crazy, since it seems impossible for anyone to get into one of the Overlord ships. But I've found a way. It doesn't happen very often, and after this it may never happen again, for I'm sure

Karellen never makes the same mistake twice. Do you know the legend of the Wooden Horse, that got the Greek soldiers into Troy? But there's a story from the Old Testament that's an even closer parallel... ."

"You'll certainly be much more comfortable than Jonah," said Sullivan. "There is no evidence that he was provided with electric light or sanitation. But you'll need a lot of. provisions, and I see you're taking oxygen. Can you take enough for a two month'! voyage in such a small space?".
He stubbed his finger on the careful sketches which Jan had laid on the table. The microscope acted as a paper weight at one end, the skull of some improbable fish held down the other.
"I hope the oxygen isn't necessary," said Jan. 'We know that they can breathe our atmosphere, but they don't seem to like it very much and I might not be able to manage theirs at all. As for the supply situation, using narcosamine solves that. It's perfectly safe. When we're under way, I'll take a shot that will knock me out for six weeks, plus or minus a few days. P11 be nearly there by then. Actually, it wasn't the food and xygen that was worrying me, so much as the boredom."

Professor Sullivan nodded thoughtfully.
"Yes, narcosamine is safe enough, and can be calibrated fairly accurately. But mind you've got plenty of food handy- you'll be ravening when you wake up, and as weak as a kitten. Suppose you starved to death because you hadn't the strength to use a can-opener?"
"I'd thought of that," said Jan, a little hurt. "I'll work up through sugar and chocolate in the usual way."
"Good: I'm glad to see that you've been into the problem thoroughly, and aren't treating it like some stunt you can back out of if you don't like the way it's going. It's your life you're playing with, but I'd hate to feel I was helping you to commit suicide."
He picked up the skull and lifted it absentmindedly in his bands. Jan grabbed the plan to prevent it rolling up.
"Luckily," continued Professor Sullivan, "the equipment you need is all fairly standard, and our shop can put it together in a few weeks. And if you decide to change your mind-"
"I won't," said Jan.

"... I've considered all the risks I'm taking, and there seems tobenoflawintheplan. Attheend ofsixweeks I'll emerge like any other stowaway and give myself up. By then- in my time, remember-the journey will be nearly over. We will be about to land on the world of the Overlords.
"Of course, what happens then is up to them. Probably I'll be sent home on the next ship-but at least I can expect to see something. I've got a four millimetre camera and thousands of metres of film: it won't be my fault if I can't use it. Even at the worst, I'll have proved that man can't be kept in quarantine forever. I'll have created a precedent that will compel Karellen to take some action.
"That, my dear Maia, is all I have to say. I know you won't miss mc greatly: let's be honest and admit that we never had very strong ties, and now that you've married Rupert you'll be quite happy in your own private universe. At least, I hope so.
"Goodbye, then, and good luck. I shall look forward to meeting ~iour grandchildren-make sure that they know about me, won t you?
"Your affectionate brother

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Wi~taii Jan first saw it, he found it hard to realize that he was not watching the fuselage of a small airliner being assembled. the metal skeleton was twenty metres long, perfectly streamlined, and surrounded by light scafibiding over which the workmen were clathbering with their power tools.
"Yes," said Sullivan in reply to Jan's question. "We use standard aeronautical techniques, and most of these men are from the aircraft industry. It's hard to believe that a thing this size could be alive, isn't it? Or could throw itself clear out of the water, as I've seen them do."
It was all very fascinating, but Jan had other things on his mind. His eyes were searching the giant skeleton to find a suitable hiding-place for his little cell-the "air-conditioned coflin", as Sullivan had christened it. On one point he was Immediately reassured. As far as space was concerned, there would be room for a dozen stowaways.
"The framework looks nearly complete," said Jan. "When will you be putting on the skin? I suppose you've already caught your whale, or you wouldn't know how large to make the skeleton."
Sullivan seemed highly amused by this remark.
"We haven't the slightest intention of catching a whale. Anyway, they don't have skins in the usual sense of the word. It would hardly be practicable to fold a blanket of blubber twenty centimetres thick around that framework. No, the whole thing will be faked up with plastics and then accurately painted. By the time we've finished, no-one will be able to tell the difference."
In that case, thought Jan, the sensible thing for the. Overlords to have done would be to take photographs and make the full-sized model themselves, back on their home planet. But perhaps their supply ships returned empty, and a little thing like a twenty-metre sperm whale would hardly be noticed. When one possessed such power and such resources, one could not be bothered with minor economics.

Professor Sullivan stood by one of the great statues that had been such a challenge to arch~cology since Easter Island was
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discovered. King, god or whatever it might be, its eyeless gaze seemed to be following his as he looked upon his handiwork. He was proud of what he had done: it seemed a pity that it would soon be banished forever from human sight.
The tableau might have been the work of some mad artist in a drugged delirium. Yet it was a painstaking copy from life:
Nature herself was the artist here. The scene was one that, until the perfection of underwater television, few men had ever glimpsed-and even then only for seconds on those rare occasions when the giant antagonists thrashed their way to the surface. These battles were fought in the endless night of the ocean depths, where the sperm whales hunted for their food. It was food that objected strongly to being eaten alive- The long, saw-toothed lower jaw of the whale was gaping wide, preparing to fasten upon its prey. The creature's head was almost concealed beneath the writhing network of white, pulpy arms with which the giant squid was fighting desperately for life. Livid sucker-marks, twenty centimetres or more in diameter, had mottled the whale's skin where those arms had fastened. One tentacle was already a truncated stump, and there could be no doubt as to the ultimate outcome of the battle. When the two greatest beasts on earth engaged in combat, the whale was always the winner. For all the vast strength of its forest of tentacles, the squid's only hope lay in escaping before that patiently grinding jaw bad sawn it to pieces. Its great expressionless eyes, half a metre across, stared at its destroyer-though, in all probability, neither creature could see the other in the darkness of the abyss.

The entire exhibit was more than thirty metres long, and had now been surrounded by a cage of aluminium girders to which the lifting tackle had been connected. Everything was ready, awaiting the Overlords' pleasure. Sullivan hoped that they would act quickly: the suspense was beginning to be uncomfortable.
Someon~e had come out of the office into the bright sunlight, obviously looking for him. Sullivan recognized his chief clerk, and walked over to meet him.
"Hello, Bill-what's the fuss?"
The other was holding a message form and looked rather pleased.
"Some good news, Professor. We've been honoured! The Supervisor himself wants to come and look at our tableau
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before it's shipped off. Just think of the publicity we'll geti It will help a lot when we apply for our new grant. I'd been
hoping for something like this."
Professor Sullivan swallowed hard. He never objected to publicity, but this time he was afraid he might get altogether too much.

Karellen stood by the head of the whale and looked up at the great, blunt snout and the ivory-studded Jaw. Sullivan, concealing his unease, wondered what the Supervisor was thinking. His behaviour had not hinted at any suspicion, and the visit could be easily explained as a normal one. But Sullivan would be very glad when it was over.
'We've no creatures as large as this on our planet," said Karellen. "That is one reason why we asked you to make this group. My-er--compatriots will find it fascinating."
"With your low gravity," answered Sullivan, "I should have thought you would have had some very large ~nima1s~ Alter all, look how much bigger you are than us !"
"Yes-but we have no oceans. And where size is concerned, the land can never compete with the sea."
That was perfectly true, thought Sullivan. And as far as he knew, this was a hitherto unrevealed fact about the world of the Overlords. Jan, confound him, would be very interested.
At the moment that young man was sitting in a hut a kilometre away, anxiously watching the inspection through field-.
glasses. He kept telling himself that there was nothing to fear.
No inspection of the whale, however close, could reveal its secret. But there was always the chance that Karellen suspected something-and was playing with them.
It was a suspicion that was growing in Sullivan's mind as the Supervisor peered into the cavernous throat.
"In your Bible," said Karellen, "there is a remarkable story of a Hebrew prophet, one Jonah, who was swallowed by a whale and thus carried safely to land after he had been cast from a ship. Do you think there could be any basis of fact in such a legend?"
"I believe," Sullivan replied cautiously, "that there is one
fairly well-authenticated case of a whaleman being swallowed and then regurgitated with no ill-effects. Of course, if he had been inside the whale for more than a few seconds he would have suffocated. And he must have been very lucky to miss
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the teeth. It's an almost incredible story, but not quit. impossible."
"Very interesting," said Karellen. He stood for another moment staring at the great jaw, then moved on to examine the squid. Sullivan hoped he did not hear his sigh of relief.

"If I'd known what I was going to go through," said Professor Sullivan, "I'd have thrown you out of the office as soon as you tried to infect me with your insanity."
"I'm sorry about that," Jan replied. "But we've got away with it."
"I hope so. Good luck, anyway. If you want to change your mind, you've still got at least six hours."
"I won't need them. Only Karellen can stop me now. Thanks for all that you've done. If I ever get back, and write a book about the Overlords, I'll dedicate it to you."
"Much good that will do me," said Sullivan gruffly. "I'll have been dead for years." To his surprise and mild consternation, for he was not a sentimental man, he discovered that this farewell was beginning to affect him. He had grown to like Jan during the weeks they had plotted together. Moreover, he had begun to fear he might be an accessory to a complicated suicide.
He steadied the ladder as Jan climbed into the great jaw, carefully avoiding the lines of teeth. By the light of the electric torch, he saw Jan turn and wave: then he was lost in the cavernous hollow. There was the sound of the airlock hatch being opened and closed, and, thereafter, silence.
In the moonlight, that had transformed the frozen battle into a scene from a nightmare, Professor Sullivan walked slowly back to his office. He wondered what he had done, and where it would lead. But this, of course, he would never know. Jan might walk this spot again, having given no more than a few months of his life in travelling to the home of the Overlords and returning to Earth. Yet if he did so, it would be on the other side of Time's impassable barrier, for it would be eighty years in the future.
The lights went on in the tiny metal cylinder as soon as Jan bad closed the inner door of the lock. He allowed himself no time for second thoughts, but began immediately upon the routine check he had already worked out. All the stores and

provisions bad been loaded days ago, but a final recheck would put him in the right frame of mind, by assuring him that nothing had been left undone.
An hour later, he was satisfied. He lay back on the sponge-rubber couch and recapitulated his plans. The only sound was the faint whirr of the electric calendar dock, which would warn him when the voyage was coming to its end.
He knew that he could expect to feel nothing here in his cell, for whatever tremendous forces drov'e the ships of the Overlords must be perfectly compensated. Sullivan had checked that, pointing out that his tableau would collapse if subjected to more than a few gravities. His-clients-had assured him that there was no danger on this score. -
There would, however, be a considerable change of atmospheric pressure. This was unimportant, since the hollow models could "breathe" through several orifices. Before he left his cell, Jan would have to equalize pressure, and he had assumed that the atmosphere inside the Overlord ship was unbreathable. A simple face-mask and oxygen set would take care of that: there was no need for anything elaborate. If he could breathe without mechanical aid, so much the better.
There was no point in waiting any longer: it would only be a strain on the nerves. He took out the little syringe, already loaded with the carefully prepared solution. Narcosamine had been discovered during research into animal hibernation: it was not true to say-as was popularly believed-that it produced suspended animation. All it caused was a great slowing-down of the vital processes, though metabolism still continued at a reduced level. It was as if one had banked up the fires of life, so that they smouldered underground. But when, after weeks or months, the effcct of the drug wore off, they would burst out again and the sleeper would revive. Narcosamine was perfectly safe. Nature

had used it for a milliOn years to protect many of her children from the foodless winter.
So Jan slept. He never felt the tug of the hoisting cables as the huge metal framework was lifted into the hold of the Overlord freighter. He never hcaid the hatches dose, not to open again for three hundred million million kilometres. He never heard, far-off and faint through the mighty walls, the protesting scream of Earth's atmosphere, as the ship climbed swiftly back to its natural element. And he never felt the Stardrive go on.
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Tiu~ conference room was always crowded for these weekly meetings, but today it was so closely packed that the reporters had difficulty in writing. For the hundredth time, they gruinbled to each other at Karellen's conservatism and lack of consideration. Anywhere else in the world they could have brought TV cameras, tape recorders, and all the other tools of their highly mechanized trade. But here they had to rely on such archaic devices as paper and pencil-and even, incredible to relate, shorthand.
There had, of course, been several attempts to smuggle in recorders. They had been successfully smuggled out again, but a single glance at their smoking interiors had shown the futility of the experiment. Everyone understood, then, why they had always been warned, in their own interest, to leave watches and other metallic objects outside the conference room.
To make things more unfair, Karellen himself recorded the whole proceedings. Reporters guilty of carelessness, or downright misrepresentation-though this was very rare-had been summoned to short and unpleasant sessions with Karellen's underlings and required to listen attentively to playbacks of what the Supervisor had really said. The lesson was not one that ever had to be repeated.
It was strange how these rumours got around. No prior announcement was made, yet there was always a full house whenever Karellen had an important statement to make- which happened, on the average, two or three times a year.
Silence descended on the murmuring crowd as the great doorway split open and Karellen caine forward on to the dais. The light here was dim-approximating, no doubt, to that of the Overlords' far distant sun-so that, the Supervisor for Earth had discarded the dark glasses he normally wore when in the open.
He replied to the ragged chorus of greetings with a formal
"Good morning, everybody," then turned to the tall, distinguished figure at the front of the crowd. Mr. Golde, doyen of the Press Club, might have been the original inspirer of the butler's announcement: "Three reporters, m'lud, and a gentleman from The Times." He dressed and behaved like a diplomat
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of the old school: no-one would ever hesitate to confide in him, and no-one had ever regretted it subsequently.
"Quite a crowd today, Mr. Golde. There must be a shortage of news."
The gentleman from The Times smiled and cleared his throat.
"I hope you can rectify that, Mr. Supervisor."
He watched intently as Karellen considered his reply. It seemed so unfair that the Overlords' faces, rigid as masks, betrayed no trace of emotion. The great, wide eyes, their pupils sharply contracted even in this indifferent light, stared fathonilessly back into the frankly curious human ones. The twin breathing orifices on either cheek-if those fluted, basalt curves could be called cheeks-emitted the faintest of whistles as Karellen's hypothetical lungs laboured in the thin air of Earth. Golde could just see the curtain of tiny white hairs fluttering to and fro, keeping accurately out of phase, as they responded to Karellen's rapid, double-action breathing cycle. Dust filters, they were generally believed to be, and elaborate theories concerning the atmosphere of the Overlords' home bad been constructed on this slender foundation.

"Yes, I have some news for you. As you are doubtless aware, one of my supply ships recently left Earth to return to its base. We have just discovered that there was a stowaway on board."
A hundred pencils braked to a halt: a hundred pairs of eyes fixed themselves upon Karellen.
"A stowaway, did you say, Mr. Supervisor?" asked Golde. "May we ask who he was- and how he got aboard?"
"His name is Jan Rodricks: he is an engineering student from the University of Cape Town. Further details you can no doubt discover for yourselves through your own very efficient channels."
Karellen smiled. The Supervisor's smile was a curious affair. Most of the effect really resided in the eyes: the inflexible, lipless mouth scarcely moved at all. Was this, Golde wondered, another of the many human customs that Karellen bad copied with such skill? For the total effect was, undoubtedly, that of a smile, and the mind readily accepted it as such.
"As for how he left," continued the Supervisor, "that is of secondary importance. I can assure you, or any other potential astronauts, that there is no possibility of repeating the exploit."

"What will happen to this young man?" persisted Golde.
"Will he be sent back to Earth?"
"That is outside my jurisdiction, but I expect he will come back Ofl the next ship. He would find conditions too-alien- fur comfort where he has gone. And this leads me to the main purpOSe of our meeting today."
J(arellen paused, and the silence grew even deeper.
"There has been some complaint, among the younger and more romantic elements of your population, because outer space has been closed to you. We had a purpose in doing this: we do not impose bans for the pleasure of it. But have yoU ever stopped to consider-if you will excuse a slightly ~attering analogy-what a man from your Stone Age would have felt, if he suddenly found himself in a modern city?"
"Surely," protested the Herald Tribune, "there is a fundamental difference. We are accustomed to Science. On your world there are doubtless many things which we might not understand-but they wouldn't seem magic to us."
"Are you quite sure of that?" said Karellen, so softly that it was hard to hear his words. "Only a hundred years lies be~ween the age of electricity and the age of steam, but what would a Victorian engineer have made of a television set or an electronic computer. And how long would he have lived if he started to investigate their workings? The gulf between two ~~~bnologies can easily become so great that it is-lethal."
("Hello," whispered Reuters to the B.B.C. "We're in luck.

He's going to make a major policy statement. I know the symptoIflS.)
"And there are other reasons why we have restricted the human race to Earth. Watch."
The lights dimmed and vanished. As they faded, a milky opalescence formed in the centre of the room. It congealed intO a whirlpool of stars-a spiral nebula seen from a point far beyond its outermost sun.
"No human eyes have ever seen this sight before," said Karellen's voice from the darkness. "You arc looking at your own Universe, the island galaxy of which your Sun is a member, from a distance of half a million light-years."
There was a long silence. Then Karellen continued, and now his voice held something that was not quite pity and not ~1.ecisely scorn.

"Your race has shown a notable incapacity for dealing with the problems of its own rather small planet. When we arrived, you were on the point of destroying yourselves with the powers that Science had rashly given you. Without our intervention, the Earth today would be a radioactive wilderness.
"Now you have a world at peace, and a united race. Soon you will be sufficiently civilized to run your planet without our assistance. Perhaps you could eventually handle the problems of an entire Solar System-say fifty moons and planets. But do you really imagine that you could ever cope with this?"
The nebula expanded. Now the individual stars were rushing past, appearing and vanishing as swiftly as sparks from a forge. And each of those transient sparks was a sun, with who knew how many circling worlds....
"In this single galaxy of ours," murmured Karellen, "there are eighty-seven thousand million suns. Even that figure gives only a faint idea of the immensity of space. In challenging it, you would be like ants attempting to label and classify all the grains of sand in all the deserts of the world.
"Your race, in its present stage of evolution, cannot face that stupendous challenge. One of my duties has been to protect you from the powers and forces that lie among the stars- fbroes beyond anything that you can ever imagine."
The image of the galaxy's swirling fire-mists faded: light returned to the sudden silence of the great chamber.
Karellen turned to go: the audience was over. At the door he paused and looked back upon the hushed crowd.
"It is a bitter thought, but you must face it. The planets you may one day possess. But the stars are not for Man."

"The stars are not for Man." Yes, it would annoy them to have the celestial portals slammed in their faces. But they must learn to face the truth-or as much of the truth as could mercifully be given to them.
From the lonely heights of the stratosphere, Karellen looked lown upon the world and the people that had been given into ~is reluctant keeping. He thought of all that lay ahead, and what this world would be only a dozen years from now.
They would never know how lucky they had been. For a

lifetime Mankind had achieved as much happiness as any race can ever know. It had been the Golden Age. But gold was also the colour of sunset, of autumn: and only Karellen's ears could catch the first wailings of the winter storms.
And~only Karellen knew with what inexorable swiftness the Golden Age was rushing to its close.

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THE LAST GENERATION

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"LOOK at this!" exploded George Greggson, hurling the paper across at Jean. It came to rest, despite her efforts to intercept it, spread listlessly across the breakfast table. Jean patiently scraped away the jam and read the offending passage, doing her best to register disapproval. She was not very good at this, because all too often she agreed with the critics. Usually she kept these heretical opinions to herself; and not merely for the sake of peace and quiet. George was perfectly prepared to accept praise from her (or anyone else), but if she ventured any criticism of his work she would receive a crushing lecture on her artistic ignorance.

She read the review twice, then gave up. It appeared quite favourable, and she said so.
"He seemed to like the performance. What are you grumbling about?"
"This," snarled George, stubbing his finger at the middle of the column. "Just read it again."
"'Particularly restful on the eyes were the delicate pastel greens of the background to the ballet sequence.' Well?"
"They weren't greens! I spent a lot of time getting that exact shade of blue! And what happens? Either some blasted engineer in the control room upsets the colour balance, or that idiot of a reviewer's got a cock-eyed set. Hey, what colour did it look on our receiver?"
"Er-I can't remember," confessed Jean. "The Poppet started squealing about then and I had to go and find what was wrong with her."
"Oh," said George, relapsing into a gently simmering quiescence. Jean knew that another eruption could be expected at any moment. When it came, however, it was fairly mild.
"I've invented a new definition for TV," he muttered
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gloomily. "I've decided it's a device for hindering communication between artist and audience."
"What do you want to do about it?" retorted Jean. "Go back to the live theatre?"
"And why not?" asked George. "That's exactly what I hat'. been thinking about. You know that letter I received from the New Athens people? They've written to me again. This time I'm going to answer."
"Indeed?" said Jean, faintly alarmed. "I think they're a lot of cranks."
"Well, there's only one way to find out. I intend to go and see them in the next fortnight. I must say that the literature they put out looks perfectly sane. And they've got some very good men there."
"If you expect me to start cooking over a wood fire, or learning to dress in skins, you'll have-"
"Oh, don't be silly! Those stories are just nonsense. The Colony's got everything that's really needed for civilized life. They don't believe in unnecessary frills, that's all. Anyway, it's a couple of years since I visited the Pacific, It will make a trip for us both."
"I agree with you there," said Jean. "But I don't intend Junior and the Poppet to grow up into a couple of Polynesian savages."
"They won't," said George. "I can promise you that."
He was right, though not in the way he had intended.

"As you noticed when you flew in," said the little man on the other side of the veranda, "the Colony consists of two islands, linked by a causeway. This is Athens, the other we've christened Sparta. It's rather wild and rocky, and is a wonderful place for sport or exercise." His eye flickered momentarily over his visitor's waistline, and George squirmed slightly in the cane chair. "Sparta is an extinct volcano, by the way. At least the geologists say it's extinct, ha-ha!
"But back to Athens. The idea of the Colony, as you've gathered, is to build up an independent, stable cultural group with its own artistic traditions. I should point out that a vast amount of research took place before we started this enterprise. It's really a piece of applied social engineering, based on some exceedingly complex mathematics which I wouldn't pretend
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to understand. All I know is that the mathematical sociologists have computed how large the Colony should be, how many types of people it should contain-and, above all, what constitution it should have fur long-term stability.
"We're ruled by a Council of eight directors, representing Production, Power, Social Engineering, Art, Economics, Science, Sport, and Philosophy. There's no

permanent chairman or president. The chair's held by each of the directors in rotation for a year at a time.
"Our present population is just over fifty thousand, which is a little short of the desired optimum. That's why we keep our eyes open for recruits. And, of course, there is a certain wastage: we're not yet quite self-supporting in some of the more specialized talents.
"Here on this island we're trying to save something of humanity's independence, its artistic traditions. We've no hostility towards the Overlords: we simply want to be left alone to go our own way. When they destroyed the old nations and the way of life man had known since the beginning of history, they swept away many good things with the bad. The world's now placid, featureless and culturally dead: nothing really new has been created since the Overlords came. The reason's obvious. There's nothing left to struggle for, and there are too many distractions and entertainments. Do you realize that every day something like five hundred hours of radio and TV pour out over the various channels? If you went without sleep and did nothing else, you could follow less than a twentieth of the entertainment that's available at the turn of a switch! No wonder that people are becoming passive sponges-absorbing but never creating. Did you know that the average viewing time per person is now three hours a day? Soon people won't be living their own lives any more. It will be a full-time job keeping up with the various family serials on
TV!
"Here, in Athens, entertainment takes its proper place. Moreover, it's live, not canned. In a community this size it is possible to have almost complete audience participation, with all that that means to the performers and artists. Incidentally we've got a very fine symphony orchestra-probably among the world's half-dozen best.
"But I don't want you to take my word for a]1 this. What usually happens is that prospective citizens stay here a few

days, getting the feel of the place. If they decide they'd like to join us, then we let them take the battery of psychological tests
whicharereallyourmainlineofdefence. About athirdof the applicants are rejected, usually fur reasons which don't reflect on them and which wouldn't matter outside. Those who pass go home long enough to settle their affairs, and then rejoin us. Sometimes, they change their minds at this stage, but that's very unusual and almost invariably through personal reasons outside their controL Our tests are practically a hundred-per-cent reliable now: the people they pass are the people who really want to come."
"Suppose anyone changed their mind later?" asked Jean anxiously.
"Then they could leave. There'd be no difficulty. It's happened once or twice."
There was a long silence. Jean looked at George, who was rubbing thoughtfully at the side-whiskers currently popular in artistic circles. As long as they weren't burning their boats behind them, she was not unduly worried. The Colony looked an interesting place, and certainly wasn't as cranky as she'd feared. And the children would love it. That, in the final analysis, was all that mattered.

They moved in six weeks later. The single-storied house was small, but quite adequate for a family which had no intention of being greater than four. All the basic labour-saving devices were in evidence: at least, Jean admitted, there was no danger of reverting to the dark ages of domestic drudgery. It was slightly disturbing, however, to discover that there was a kitchen. In a community of this size, one would normally expect to dial Food Central, wait five minutes, and then get whatever meal they had selected. Individuality was all very well, but this, Jean feared, might be taking things a little too far. She wondered darkly if she would be expected to make the family's clothes as well as to

prepare its meals. But there was no spinning-wheel between the automatic dish-washer and the radar range, soit wasn't quite as bad as that....
Of course, the rest of the house still looked very bare and raw. They were its first occupants, and it would be some time before all this aseptic newness had been converted into a warm, human home, The children, doubtless, would catalyze the
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process rather effectively. There was already (though Jean did not know it yet) an unfortunate victim of Jeffrey's expiring in the bath, as a result of that young man's ignorance of the fundamental difference between fresh and salt water.
Jean moved to the still uncurtained window and looked across the Colony. It was a beautiful place, there was no doubt
of that. The house stood on the western slopes of the low bill that dominated, because of the absence of any other competition, the island of Athens. Two kilometres to the north she could see the causeway-a thin knife-edge dividing the water- that led to Sparta. That rocky island, with its brooding volcanic cone, was such a contrast to this peaceful spot that it sometimes frightened her. She wondered how, the scientists could be so certain that it would never reawaken and overwhelm them all.
A wavering figure coming up the slope, keeping carefully to the palm-trees' shade in defiance of the rule of the road, attracted her eye. George was returning from his first conference. It was time to stop day-dreaming and get busy about the house.
A metallic crash announced the arrival of George's bicycle.
Jean wondered how long it was going to take them both to learn to ride. This was yet another unexpected aspect of life on the island. Private cars were not permitted, and indeed were unnecessary, since the greatest distance one could travel in a straight line was less than fifteen kilometres. There were various community-owned service vehicles-trucks, ambulances, and fire-engines, all restricted, except in cases of real emergency, to fifty kilometres an hour. As a result the inhabitants of Athens had plenty of exercise, uncongested streets -and no traffic accidents.
George gave his wife a perfunctory peck and collapsed with a sigh of relief into the nearest chair.
"Phew I" he said, mopping his brow. "Everyone raced past me on the way up the hill, so I suppose people do get used wit.
I think I've lost ten kilograms already."
"What sort of a day did you have?" asked Jean dutifully. She hoped George would not be too exhausted to help with the unpacking.
"Very stimulating. Of course 1 can't remember half the people I met, but they all seemed very pleasant. And the theatre is just as good as I'd hoped. We're starting work next
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week on Shaw's 'Back to Methuselah'. I'll be in complete
charge of sets and stage design. It'll make a change, not having
a dozen people to tell me what I can't do. Yes, I think we're going to like it here."
"Despite the bicycles?"
George summoned up enough energy to grin.
"Yes," he said. "In a couple of weeks I won't even notice this little hill of ours."
He didn't really believe it-but it was perfectly true. It was another month, however, before Jean ceased to pine for the
car, and discovered all the things one could do with one's own
kitchen.

New Athens was not a natural and spontaneous growth like the city whose name it bore. Everything about the Colony was deliberately planned, as the result of many years of study by a group of very remarkable men. It had begun as an open conspiracy against the Overlords, an implicit challenge to their policy if not to their power. At first the Colony's sponsors had been more than half certain that Karellen would neatly frustrate them, but the Supervisor had done nothing-absolutely nothing. This was not quite as reassuring as might have been expected. Karellen had plenty of time: he might be preparing a delayed counterstroke. Or he might be so certain of the project's failure that he felt no need to take any action against it.

That the Colony would fail had been the prediction of most people. Yet even in the past, long before any real knowledge of social dynamics had existed, there had been many communities devoted to special religious or philosophical ends. It was true that their mortality rate had been high, but some had survived. And the foundations of New Athens were as secure as modern science could make them.

There were many reasons for choosing an island site. Not the least important were psychological. In an age of universal air transport, the ocean meant nothing as a physical barrier, but it still gave a sense of isolation. Moreover, a limited land area made it impossible for too many people to live in the Colony. The maximum population was fixed at a hundred thousand: more than that, and the advantages inherent in a small, compact community would be lost. One of the aims of the founders was that any member of New Athens should

know all the other citizens who shared his interests-and as many as one or two per cent of the remainder as well.

The man who had been the driving force behind New Athens was a Jew. And, like Moses, he had never lived to enter his promised land, for the Colony had been founded three years after his death.

He had been born in Israel, the last independent nation ever to come into existence-and, therefore, the shortest lived. The end of national sovereignty had been felt here perhaps more bitterly than anywhere else, for it is hard to lose a dream which one has just achieved after centuries of striving.

Ben Salomon was no fanatic, but the memories of his childhood must have determined, to no small extent, the philosophy he was to put into practice. He could just remember what the world had been before the advent of the Overlords, and had no wish to return to it. Like not a few other intelligent and well-meaning men, he could appreciate all that Karellen had done for the human race, while still being unhappy about the Supervisor's ultimate plans. Was it possible, he sometimes said to himself that despite all their enormous intelligence the Overlords did not really understand mankind, and were making a terrible mistake from the best of motives? Suppose, in their altruistic passion for justice and order, they had determined to reform the world, but had not realized that they were destroying the soul of man?

The decline had barely started, yet the ftrst symptoms of decay were not hard to discover. Salomon was no artist, but he had an acute appreciation of art and knew that his age could riot match the achievements of previous centuries in any single field. Perhaps matters would right themselves in due course, when the shock of encountering the Overlord civilization had worn off. But it might not, and a prudent man would consider taking out an insurance policy.

New Athens was that policy. Its establishment had taken twenty years and some billions of Pounds Decimal-a relatively trivial factor, therefore, of the world's total wealth. Nothing had happened for the first fifteen years: everything had happened in the last five.

Salomon's task would have been impossible had he not been able to convince a handful of the world's most famous artists that his plan was sound. They had

sympathized because it appealed to their egos, not because it was important for the
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race. But, once convinced, the world had listened to them and given both moral and material support. Behind this spectacular façade of temperamental talent the real architects of the Colony had laid their plans.
A society consists of human beings whose behaviour as individuals is unpredictable. But if one takes enough of the basic units, then certain laws begin to appear-as was discovered long ago by life-insurance companies. No-one can tell what individuals will die in a given time-yet the total number of deaths can be predicted with considerable accuracy.
There are other, subtler laws, first glimpsed in the early twentieth century by mathematicians such as Weiner and Rashavesky. They had argued that such events as economic depressions, the results of armament races, the stability of social groups, political elections, and so on could be analysed by the correct mathematical techniques. The great difficulty was the enormous number of variables, many of them hard to define in numerical terms. One could not draw a set of curves and state definitely: "When this line is reached, it will mean war." And one could never wholly allow for such utterly unpredictable events as the assassination of a key figure or the effects of some new scientific discovery-still less such natural catastrophes as earthquakes or floods, which might haves profound effect on large numbers of people and the social groups in which they lived.
Yet one could do much, t1~ianks to the knowledge patiently accumulated during the past hundred years. The task would have been impossible without the aid of the giant computing machines that could perform the work of a thousand human calculators in a matter of seconds. Such aids had been used to the utmost when the Colony was planned.
Even so, the founders' of New Athens could only provide the soil and the climate in which the plant they wished to cherish might-or might not-come to flower. As Salomon himself had remarked: "We can be sure of talent: we can only pray for genius." But it was a reasonable hope that in such a concentrated solution some int~resting reactions would take place. Few artists thrive in solitude, and nothing is more stimulating than the conflict of minds with similar interests. So far, the conflict had produced worthwhile results in sculpture, music, literary criticism and film-making. It was still too early to see if the group working on historical research

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would fulfil the hopes of its instigators, who were frankly aiming at restoring mankind's pride in its own achievements. Painting still languished, which supported the view of those who considered that static, two-dimensional forms of art had no further possibilities.
It was noticeable-though a satisfactory explanation fbr this had not yet been produced-that time played an essential part in the .Colony's most successful artistic achievements. Even its sculpture was seldom immobile. Andrew Carson's intriguing volumes and curves changed slowly as one watched, according to complex p~tterns that the mind could appreciate, even if it could not fully comprehend them. Indeed, Carson claimed, with some truth, to have taken the "mobiles" of a century before to their ultimate conclusion, and thus to have wedded sculpture and ballet.
Much of the Colony's musical experimenting was, quite consciously, concerned with what might be called "time span". What was the briefest note that the mind could grasp-or the longest that it could tolerate without boredom? Could the result be varied by conditioning or by the use of appropriate orchestration? Such problems were discussed endlessly, and the arguments were not purely academic. They had resulted in some extremely interesting compositions.

But it was in the art of the cartoon film, with its limitless possibilities, that New Athens had made its most successful experiments. The hundred years since the time of Disney had still left much undone in this most flexible of all mediums. On the purely realistic side, results could be produced indistinguishable from actual photography-much to the contempt of those who were developing the cartoon along abstract lines.

The group of artists and scientists that had so far done least was the one that had attracted the greatest interest-and the greatest alarm. This was the team working on "total identification". The history of the cinema gave the clue to their actions. First, sound, then colour, then stereoscopy, then Cinerama, had made the old 'moving pictures" more and more like reaiity itself. Where was the end of the story? Surely, the final stage would be reached when the audience forgot it was an audience, and became part of the action. To achieve this would involve stimulation ~f all the Senses, and perhaps h
nosis as wcll, but many beheved it to be practical. When
goal was attained, there would be an enormous enrichment of
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human experience. A man could become-for a while, at least-any other person, and could take part in any conceivable adventure, real or imaginary. He could even be plant or animal, if it proved possible to capture and record the sense impressions of other living creatures. And when the "programme" was over, he would have acquired a memory as vivid as any experience in his actual life-indeed, indistinguishable from reality itself.

The prospect was dazzling. Many also found it terrifying, and hoped that the enterprise would fail. But they knew in their hearts that once science had declared a thing possible, there was no escape from its eventual realization....

This, then, was New Athens and some of its dreams. It hoped to become what the old Athens might have been had it possessed machines instead of slaves, science instead of superstition. But it was much too early yet to tell if the experiment would succeed.

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Jm'i~lu~Y Gi~GsoN was one islander who, as yet, had no interest in esthetics or science, the two main preoccupations of his elders. But he heartily approved of the Colony, for purely personal reasons. The sea, never more than a few kilometres away in any direction, fascinated hini. Most of his short life bad been spent far inland, and he was not yet accustomed to the novelty of being surrounded by water. He was a good swimmer, and would often cycle off with other young friends, carrying his fins and mask, to go exploring the shallower water of the lagoon. At first Jean was not very happy about this, but after she had made a few dives herself; she lost her fear of the sea and its strange creatures and let Jeffrey enjoy himself as he pleased-on condition that he never swam alone.

The other member of the Greggson household who approved of the change was Fey, the beautiful golden retriever who nominally belonged to George, but could seldom be detached from Jeffrey. The two were inseparable, both by day and-if Jean had not put her foot down-by night. Only when Jeffrey went off on his bicycle did Fey remain at home, lying listlessly in front of the door and staring down the road

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with moist, mournful eyes, her muzzle resting on her paws.

This was rather mortifying to George, who had paid a stiff price for Fey and her pedigree. It looked as if he would have to wait for the next generation-due in

three months-before he could have a dog of his own. Jean had other views on the subject. She liked Fey, but felt that one hound per house was quite sufficient. Only Jennifer Anne had not yet decided whether she liked the Colony. That, however, was hardly surprising, for she had so far seen nothing of the world beyond the plastic panels of her cot, and had, as yet, very little suspicion that such a place existed.

George Greggson did not often think about the past: he was too busy with plans for the future, too much occupied by his work and his children. It was rare indeed that his mind went back across the years to that evening in Africa, and he never talked about it with Jean. By mutual consent, the subject was avoided, and since that day they had never visited the Boyces again, despite repeated invitations. They called Rupert with fresh excuses several times a year, and lately he bad ceased to bother them. His marriage to Maia, rather to everyone's surprise, still seemed to be flourishing.

One result of that evening was that Jean had lost all desire to dabble with mysteries at the borders of known science. The naive and uncritical wonder that had drawn her to Rupert and his experiments bad completely vanished. Perhaps she had been convinced and wanted no more proof: George preferred not to ask her. It was just as likely that the cares of maternity had banished such interests from her mind.

There was no point, George knew, in worrying about a mystery that could never be solved, yet sometimes in the stillness of the night he would wake and wonder. He remembered his meeting with Jan Rodericks on the roof of Rupert's house, and the few words that were all he had spoken with the only human being successfully to defy the Overlords' ban. Nothing in the realm of the supernatural, thought George, could be more eerie than the plain scientific fact that though almost ten years had passed since he had spoken to Jan, that now-far-distant voyager would have aged by only a few days.

The universe was vast, but that fact terrified him less than its

mystery. George was not a person who thought deeply on such matters, yet sometimes it seemed to him that men were like children amusing themselves in some secluded playground, protected from the fierce realities of the outer world. Jan Rodricks had resented that protection and had escaped from it -into no-one knew what. But in this matter George found himself on the side of the Overlords. He bad no wish to face whatever ~1urked in the unknown darkness, just beyond the little circle of light cast by the lamp of Science.

"How is it?" said George plaintively, "that Jeff's always off somewhere when I happen to be home? Where's he gone today?"

Jean looked up from her knitting-an archaic occupation which had recently been revived with much success. Such fashions came and went on the island with some rapidity. The main result of this particular craze was that the men had now all been presented with multi-coloured sweaters, far too hot to wear in the daytime but quite useful after sundown.

"He's gone off to Sparta with some friends," Jean replied. "He promised to be back for dinner."

"I really came home to do some work," said George thoughtfully. "But it's a nice day, and I think I'll go out there and have a swim myself. What kind of fish would you like me to bring back?"

George had never caught anything, and the fish in the lagoon were much too wily to be trapped. Jean was just going to point this out when the stillness of the afternoon was shattered by a sound that still had power, even in this peaceful age, to chill the blood and set the scalp crawling with apprehension.
It was the wail of a siren, rising and filling, spreading its message of danger in concentric circles out to sea.

For almost a hundred years the stresses had been slowly increasing, here in the burning darkness deep beneath the ocean's floor. Though the submarine canyon had been formed geological ages ago, the tortured rocks had never reconciled themselves to their new positions. Countless times the strata bad creaked and shifted, as the unimaginable weight of water disturbed their precarious equilibrium. They were ready to move again.
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Jeff was exploring the rock pools along the narrow Spartan beach-an occupation he found endlessly absorbing. One never knew what exotic creatures one might find, sheltered here from the waves that marched forever across the Pacific to spend themselves against the reef. It was a fairyland for any child, and at the moment he possessed it all himself, for his friends had gone up into the hills.
The day was quiet and peaceful. There was not a breath of wind, and even the perpetual muttering beyond the reef had sunk to a sullen undertone. A blazing sun hung half-way down the sky, but Jeff's mahogany-brown body was now quite immune to its onslaughts.
The beach here was a narrow belt of sand, sloping steeply towards the lagoon. Looking down into the glass-clear water, Jeff could see the submerged rocks which were as familiar to him as any formations on. the land. About ten metres down, the weed-covered ribs of an ancient schooner curved up towards the world it had left almost two centuries ago. Jeff and his friends had often explored the wreck, but their hopes of hidden treasure had been disappointed. All that they had ever retrieved was a barnacle-encrusted compass.
Very firmly, something took hold of the beach and gave it a single, sudden jerk. The tremor passed so swiftly that Jeff wondered if he had imagined it. Perhaps it was a momentary giddiness, for all around him remained utterly unchanged. The waters of the lagoon were unruffled, the sky empty of cloud or menace. And then a very strange thing began to happen.
Swifter than any tide could ebb, the water was receding from the shore. Jeff watched, deeply puzzled and not in the least afraid, as the wet sands were uncovered and lay sparkling in the sun. He followed the retreating ocean, determined to make the most of whatever miracle had opened up the underwater world for his inspection. Now the level had sunk so far that the broken mast of the old wreck was climbing into the air, its weeds hanging limply from it as they lost their liquid support. Jeff hastened forward, eager to see what wonders would be uncovered next.
It was then that he noticed the sound from the reef. He had never heard anything like it before, anLi he stopped to think the matter over, his bare feet slowly sinking into the moist sand. A great fish was thrashing in its death agonies a few
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metres away, but Jeff scarcely noticed it. He stood, alert and listening, while the noise from the reef grew steadily around him.
It was a sucking, gurgling sound, as of a river racing through a narrow channel. It was the voice of the reluctantly retreating sea, angry at losing, even for a moment, the lands it rightfully possessed. Through the graceful branches of the coral, through the hidden submarine caves, millions of tons of water were draining out of the lagoon into the vastness of the Pacific.
Very soon, and very swiftly, they would return.

One of the salvage parties, hours later, found Jeff on a great block of coral that had been hurled twenty metres above the normal water level. He did not seem particularly frightened, though he was upset over the loss of his bicycle. He was also very hungry, as the partial destruction of the causeway had cut him off from home. When rescued he was contemplating swimming back to Athens, and, unless the currents had changed drastically, would doubtless have managed the cross-big without much trouble.

Jean and George had witnessed the whole sequence of events when the tsunami hit the island. Though the damage to the low-lying areas of Athens had been severe, there had been no loss of life. The seismographs had been able to give only fifteen minutes' warning, but that had been long enough to get everyone above the danger line. Now the Colony was licking its wounds and collecting together a mass of legends that would grow steadily more hair-raising through the years to come.

Jean burst into tears when her son was restored to her, for she had quite convinced herself that he had been swept out to sea. She had watched with horrified eyes as the black and foam-capped wall of water had moved roaring in from the horizon to smother the base of Sparta in spume and spray. It seemed incredible that Jeff could have reached safety in time.

It was scarcely surprising that he could not give a very rational account of what had happened. When he had eaten and was safely in bed, Jean and George gathered by his side.

"Go to sleep, darling, and forget all about it," said Jean.

"You're all right now."

"But it was fun, Mummy," protested Jeff. "I wasn't rea1~y frightened."

"That's fine," said George. "You're a brave lad, and it's a good thing you were sensible and ran in time. I've heard about
these tidal waves before. A lot of people get drowned because
they go out on the uncovered beach to see what's happened."

"That's what I did," confessed Jeff. "I wonder who it was
helped me?"

"What do you mean? There wasn't anyone with you. The other boys were up the bill."

Jeff looked puzzled.

"But someone told me to run."

Jean and George glanced at each other in mild alarm.

"You mean-you imagined you heard something?"

"Oh, don't bother him now," said Jean anxiously, and with a little too much haste. But George was stubborn.

"I want to get to the bottom of this. Tell me just ~~vhat happened, Jeff."

"Well, I was right down the beach, by that old wreck, when the voice spoke."

"What did it say?"

"I can't quite remember, but it was something like 'Jeffrey, get up the hill as quickly as you can. You'll be drowned if you stay here.' I'm sure it called me Jeffrey, not Jeff. So it couldn't have been anyone I knew."

"Was it a man's voice? And where did it come from?"

"It was ever so close beside me. And it sounded like a man. . . ." Jeff hesitated for a moment, and George prompted him.

"Go on-just imagine that you're back on the beach, and tell us exactly what happened."

"Well, it wasn't quite like anyone I've ever heard talking before. I think he was a very big man."

"Is that all the voice said?"

"Yes-until I started to climb the hill. Then another funny thing happened. You know the path up the cliff?"
"Yes."
"I was running up that, because it was the quickest way. I knew what was happening now, for I'd seen the big wave coming in. It was making an awful noise, too. And then I found there was a great big rock m the way. It wasn't there before, and I couldn't get past it."
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"The 'quake must have brought it down," said George.
"Shush! Go on, Jeff."
"I didn't know what to do, and I could hear the wave coming closer. Then the voice said 'Close your eyes, Jeffrey, and put your hand in front of your face.' It seemed a funny thing to do, but I tried it. And then there was a great flash-I could feel it all over-and when I opened my eyes the rock was gone."
"Gone?"
"That's right-it just wasn't there. So I started running again, and that's when I nearly burnt my feet, because the path was awful hot. The water hissed when it went over it, but it couldn't catch me then-I was too far up the cliff. And that's all. I came down again when there weren't any more waves. Then I found that my bike had gone, and the road home had been knocked down."
"Don't worry about the bicycle, dear," said Jean, squeezing her, son thankfully. "We'll get you another one. The only thing that matters is that. you're safe. We won't worry about how it happened."
That wasn't true, of course, for the conference began immediately they had left the nursery. It decided nothing, but it bad two sequels. The next day, without telling George, Jean took her small son to the Colony's child psychologist. He listened carefully while Jeff repeated his story, not in the least over-awed by his novel surroundings. Then, while his unsuspecting patient rejected seriatim the toys in the next room, the doctor reassured Jean.
"There's nothing on his card to suggest any mental abnormality. You must remember that he's been through a terrifying experience, and he's come out of it remarkably well. He's a highly imaginative child, and probably believes his own story.
So just accept it, and don't worry unless there are any later symptoms. Then let me know at once."
That evening, Jean passed the verdict on to her husband. He did not seem as relieved as she had hoped, and she put it down to worry over the damage to his beloved theatre. He just grunted "That's fine" and settled down with the current issue of Stage and Studio. It looked as if he had lost interest in the whole affair, and Jean felt vaguely annoyed with him.
But three weeks later, on the first day that the causeway was reopened, George and his bicycle set off briskly towards Sparta.
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The beach was still littered with masses of shattered coral, and in one place the reef itself seemed to have been breached. George wondered how long it would take the myriads of patient polyps to repair the damage.
There was only one path up the face of the dliff, and when he had recovered his breath George began the climb. A few dried fragments of weed, trapped among the rocks, marked the limit of the ascending waters.
For a long time George Greggson stood on that lonely track, staring at the patch of fused rock beneath his feet. He tried to tell himself that it was some freak of the long-dead volcano, but soon abandoned this attempt at self-deception. His mind went back to that night, years ago, when he and Jean had joined that silly experiment of Rupert Boyce's. No-one had ever really understood what had happened then, and George knew that in some unfathomable way these two strange events were linked together. First it had been Jean, now her son. He did not know whether to be glad or fearful, and in his heart he uttered a silent prayer:

"Thank you, Karellen, for whatever your people did for Jeff. But I wish I knew why they did it."
He went slowly down to the beach, and the great white gulls wheeled around him, annoyed because he had brought no food to throw them as they cirded in the sky.

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Kiu~u~'s request, though it might have been expected at any time since the foundation of the Colony, was something of a bombshell. It represented, as everyone was fully aware, a crisis in the affairs of Athens, and nobody could decide whether good or bad would come of it.
Until now, the Colony had gone its way without any form of interference from the Overlords. They had left it completely alone, as indeed they ignored most human activities that were not subversive or did not offend their codes of behaviour. Whether the Colony's aims could be called subversive was uncertain. They were non-political, but they represented a bid for intellectual and artistic independence. And from that, who knew what might come? The Overlords might well be

able to foresee the future of Athens more clearly than its founders-and they might not like it.
Of course, if Karellen wished to send an observer, inspector, or whatever one cared to call him, there was nothing that could be done about it. Twenty years ago the Overlords had announced that they had discontinued all use of their surveillance devices, so that humanity need no longer consider itself spied upon. However, the fact that such devices still existed meant that nothing could be hidden from the Overlords if they really wanted to see it.
There were some on the island who welcomed this visit as a chance of settling one of the minor problems of Overlord psychology-their attitude towards Art. Did they regard it as a childish aberration of the human race? Did they have any forms of art themselves? In that case, was the purpose of this visit purely asthetic, or did Karellen have less innocent motives?
All these matters were debated endlessly while the preparations were under way. Nothing was known of the visiting Overlord, but it was assumed that he could absorb Culture in unlimited amounts. The experiment would at least be attempted, and the reactions of the victim observed with interest by a battery of very shrewd minds.
The current chairman of the council was the philosopher, Charles Yan Sen, an ironic but fundamentally cheerful man who was not yet in his sixties and was therefore still in the prime of life. Plato would have approved of him as an example of the philosopher-statesman, though Sen did not altogether approve of Plato, whom he suspected of grossly misrepresenting Socrates. He was one of the islanders who was determined to make the most of this visit, if only to show the Overlords that men still had plenty of initiative and were not yet, as he put it, "fully domesticated".
Nothing in Athens was done without a committee, that ultimate hall-mark of the democratic method. Indeed, someone had once defined the Colony as a system of interlocking committees. But the system worked, thanks to the patient studies of the social psychologists who had been the real founders of Athens. Because the community was not too large, everyone in it could take some part in its running and could be a citizen in the truest sense of the word.
It was almost inevitable that George, as a leading member

of the artistic hierarchy, should be one of the reception committee. But he made doubly sure by pulling a few strings. If the Overlords wanted to study the Colony, George wanted equally to study them. Jean was not very happy about this. Ever since that evening at the Boyces', she had felt a vague hostility towards the Overlords, though she could never give any reason for it. She just wished to have as little to do with them as possible, and to her one of the island's main attractions had been its hoped-for independence. Now she feared that this independence might be threatened.

The Overlord arrived without ceremony in an ordinary manmade flyer, to the disappointment of those who had hoped for something more spectacular. He might have been Karellen himself, for no-one had ever been able to distinguish one Overlord from another with any degree of confidence. They all seemed duplicates from a single master-mould. Perhaps, by some unknown biological process, they were.

After the first day, the islanders ceased to pay much attention when the official car murmured past on its sightseeing tours. The visitor's correct name, Thanthalteresco, proved too intractable, for general use, and he was soon christened "The Inspector". It was an accurate enough name, for his curiosity and appetite for statistics were insatiable.

Charles Yan Sen was quite exhausted when, long after midnight, he had seen the Inspector back to the flyer which was serving as his base. There, no doubt, he would continue to work throughout the night while his human hosts indulged in the frailty of sleep.

Mrs. Sen greeted her husband anxiously on his return.

They were a devoted couple, despite his playful habit of calling her Xantippe when they were entertaining guests. She had long ago threatened to make the appropriate retort by brewing him a cup of hemlock, but fbrtunately this herbal beverage was less common to New Athens than the old.

"Was it a success?" she asked as her husband settled down to a belated meal.

"I think so-but you can never tell what goes on inside those remarkable minds. He was certainly interested, even cornplimentary. I apologized, by the way, for not inviting him here. He said he quite understood, and had no wish to bang his head on our ceiling."

"What did you show him today?"

"The bread-and-butter side of the Colony, which he didn't seem to find as boring as I always do. He asked every question
you could imagine about production, how we balanced our
budget, our mineral resources, the birth rate, how we got our food, and so on. Luckily I had Secretary Harrison with me, and he'd come prepared with every Annual Report since the
Colony began. You should have heard them swapping statistics.. The Inspector's borrowed the lot, and I'm prepared to bet that when we see him tomorrow he'll be able to quote any
figure back at us. I find that kind of mental performance frightfully depressing."

He yawned and began to peck haif-heartedly at his food.

"Tomorrow should be more interesting. We're going to do the schools and the Academy. That's when I'm going to ask some questions for a change. I'd like to know how the Overlords bring up their kids-assuming, of course, that they have any."

That was not a question that Charles Sen was ever to have answered, but on other points the Inspector was remarkably talkative. He would evade awkward queries in a manner that was a pleasure to behold, and then, quite unexpectedly, would become positively confiding.

Their first real intimacy occurred while they were driving away from the school that was one of the Colony's chief prides. "It's a great responsibility," Dr. Sen had remarked, "training these young minds ftr the future. Fortunately, human beings are extraordinarily resilient: it takes a pretty bad upbringing to do permanent damage. Even if our aims are mistaken, our little victims will probably get over it. And as yoti've seen, they appear to be perfectly happy."
He paused for a moment, then glanced mischievously up at the towering figure of his passenger. The Inspector was completely clothed in some reflecting silvery cloth so that not an inch of his body was exposed to the fierce sunlight. Behind the dark glasses, Dr. Sen was aware of the great eyes watching him emotionlessly-or with emotions which he could never understand. "Our problem in bringing up these children must, I imagine, be very similar to yours when confronted with the human race. Wouldn't you agree?"
"In some ways," admitted the Overlord gravely. "In others, perhaps a better analogy can be found in the history of your colonial powers. The Roman and British Empires, for that

reason, have always been of considerable interest to us. The case of India is particularly instructive. The main difference
between us and the British in India was that they had no real
motives for going there-no conscious objectives, that is, except such trivial and temporary ones as trade or hostil~ty to
other European powers. They found themselves possessors
of an Empire before they knew what to do with it, and were
never really happy until they had got rid of it again."
"And will you," asked Dr. Sen, quite unable to resist the opportunity, "get rid of your empire when the time arises?"
"Without the slightest hesitation," replied the Inspector.
Dr. Sen did not press the point. The forthrightness of the reply was not altogether flattering: moreover, they had now arrived at the Academy, where the assembled pedagogues were waiting to sharpen their wits on a real, live Overlord.

"As our distinguished colleague will have told you," said Professor Chance, Dean of the University of New Athens, "our main purpose is to keep the minds of our people alert, and to enable them to realize all their potentialities. Beyond this island"-his gesture indicated, and rejected, the rest of
the globe-"I fear that the human race has lost its initiative.
It has peace, it has plenty-but it has no horizons."
"Yet here, of course.. . ?" interjected the Overlord blandly.
Professor Chance, who lacked a sense of humour and was vaguely aware of the fact, glanced suspiciously at his visitor.
"Here," he continued, "we do not suffer from the ancient obsession that leisure is wicked. But we do not consider that it is enough to be passive receptors of entertainment. Everybody on this island has one ambition, which may be summed up very simply. It is todo something, however small it may be, better than anyone else. Of course, it's an ideal we don't all achieve. But in this modern world the great thing isto have an ideal. Achieving it is considerably less important."
The Inspector did not seem inclined to comment. He had discarded his protective clothing, but still wore dark glasses even in the subdued light of the Common Room. The Dean wondered if they were physiologically necessary, or whether they were merely camouflage. Certainly they made quite impossible the already difficult task of reading the Overlord's thoughts. He did not, however, seem to object to the some-

what challenging statements that had been thrown at him, or the criticisms of his race's policy with regard to Earth which they implied.
The Dean was about to press the attack when Professor Sperling, Head of the Science Department, decided to make it a three-cornered fight.
"As you doubtless know, sir, one of the great problems of our culture has been the dichotomy between art and science. I'd very much like to know your views on the matter. Do you subscribe to the view that all artists are abnormal? That their work-or at any rate the impulse behind it-is the result of some deep-seated psychological dissatisfaction?"
Professor Chance cleared his throat purposefully, but the Inspector forestalled him.
"I've been told that all men are artists to a certain extent, so that everyone is capable of creating something, if only on a rudimentary level. At your schools yesterday, for example, I noticed the emphasis placed on self-expression in drawing, painting and modelling.~The impulse seemed quite universal, even among those clearly destined to be specialists in science. So if all artists are abnormal, and all men are artists, we have an interesting syllogism.. . ."
Everyone waited for him to complete it. But when it suited their purpose the Overlords could be impeccably tactful.

The Inspector came through the symphony concert with flying colours, which was a good deal more than could be said for many human members of the audience. The only concession to popular taste bad been Stravinsky's "Symphony of Psalms": the rest of the programme was aggressively modernistic. Whatever one's views on its merits, the performance was superb, for the Colony's boast that it possessed some of the finest musicians in the world was no idle one. There had been much wrangling among the various rival composers for the honour of being included in the programme, though a few cynics wondered if it would be an honour at all. For all that anyone knew to the contrary, the Overlords might be tone deaf.
It was observed, however, that after the concert Thanthalteresco sought out the three composers who had been present, and complimented them all on what he called their "great

ingenuity". This caused them to retire with pleased but vaguely baffled expressions.
It was not until the third day that George Greggson had a chance of meeting the Inspector. The theatre had arranged a kind of mixed grill rather than a single dish-two one-act plays, a sketch by a world-famous impersonator, and a ballet sequence. Once again all these items were superbly executed and one critic's predicnon-"Now at least we'll discover if the Overlords can yawn"-was falsified. Indeed, the Inspector laughed several times, and in the correct places.
And yet-no-one could be sure. He might himself be putting on a superb act, following the performance by logic alone and with his own strange emotions completely untouched, as an anthropologist might take part in some primitive rite. The fact that he uttered the appropriate sounds, and made the expected responses, really proved nothing at all.
Though George had been determined to have a talk with the Inspector, he failed utterly. After the performance they exchanged a few words of introduction, then the visitor was swept away. It was completely impossible to isolate him from his entourage, and George went home in a state of extreme frustration. He was by no means certain what he wished to say even if he had had the chance, but somehow, he felt sure, he could have turned the conversation round to Jeff. And now the opportunity had gone.
His bad temper lasted two days. The Inspector's flyer had departed, amid many protestations of mutual regard, before the sequel emerged. No-one had thought of

questioning Jeff, and the boy must have been thinking it over for a long time before he approached George.
"Daddy," he said, just prior to bedtime. "You know the Overlord who came to see us?"
"Yes," replied George grimly.
"Well, he came to our school, and I heard him talk to some of the teachers. I didn't really understand what he said-but I think I recognized his voice. That's who told me to run when the big wave came."
"You are quite sure?"
Jeff hesitated for a moment.
"Not quite-but if it wasn't him, it was another Overlord. I wondered if I ought to thank him. But he's gone now, hasn't he?"
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"Yes," said George. "I'm afraid he has. Still, perhaps we'll have another chance. Now go to bed like a good boy and don't worry about it any more."
When Jeff was safely out of the way, and Jenny had been attended to, Jean came back and sat on the rug beside George's chair, leaning against his legs. It was a habit that struck him as annoyingly sentimental, but not worth creating a fuss about.
He merely made his knees as nobbly as possible.
"What do you think about it now?" asked Jean in a tired, flat voice. "Do you believe it really happened?"
"It happened," George replied, "but perhaps we're foolish to worry. After all, most parents would be grateful-and of course, I am grateful. The explanation may be perfectly simple. We know that the Overlords have got interested in the Colony, so they've undoubtedly been observing it with their instruments-despite that promise they made. Suppose one was just prowling round with that viewing gadget of theirs, and saw the wave coming. It would be natural enough to warn anyone who was in danger."
"But he knew Jeff's name, don't forget that. No, we're being watched. There's something peculiar about us, something that attracts their attention. I've felt it ever since Rupert's party. It's funny how that changed both our lives."
George looked down at her with sympathy, but nothing more. It was strange how much one could alter in so short a time. He was fond of her: she had borne his children and was part of his life. But of the love which a not-clearly-remembered person named George Greggson had once known towards a fading dream called Jean Morrel, how much remained?
His love was divided now between Jeff and Jennifer on the one hand-and Carolle on the other. He did not believe that Jean knew about Carolle, and he intended to tell her before anyone else did. But somehow he had never got round to it.
"Very well-Jeff is being watched-protected, in fact.
Don't you think that should make us proud? Perhaps the Overlords have planned a great future for him. I wonder what it can be?"
He was talking to reassure Jean, he knew. He was not greatly disturbed himself~ only intrigued and baffled. And quite suddenly another thought struck him, something that

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should have occurred to him before. His eyes turned autonatically towards the nursery.
"I wonder if it's only Jeff they're after," he said.

In due course the Inspector presented his report. The Islanders would have given much to see it. All the statistics md records went into the insatiable memories of the great omputers which were some, but not all, of the unseen powers hehind

Karellen. Even before these impersonal electric minds had arrived at their conclusions, however, the Inspector had given his own recommendations. Expressed in the thoughts and language of the human race, they would have run as follows:
'We need take no action regarding the Colony. It is an interesting experiment, but cannot in any way affect the future. Its artistic endeavours are no concern of ours, and there is no evidence that any scientific research is progressing along dangerous channels.
"As planned, I was able to see the school records of Subject Zero, without arousing curiosity. The relevant statistics are attached, and it will be seen that there are still no signs of any unusual development. Yet, as we know, Breakthrough seldom gives much prior warning.
"I also met the Subject's father, and gathered the impression that he wished to speak to me. Fortunately I was able to avoid this. There is no doubt that he suspects something, though of course he can never guess the truth nor affect the outcome in any way.
"I grow more and more sorry for these people."

George Greggson would have agreed with the Inspector's verdict that there was nothing unusual about Jeff. There was just that one baffling incident, as startling as a single clap of thunder. on a long, calm day. And after that-nothing.
Jeff bad all the energy and inquisitiveness of any other seven-year-old. He was intelligent-when he bothered to be
-but was in no danger of becoming a genius. Sometimes, Jean thought a little wearily, he filled to perfection the classic recipe for a small boy: "a noise surrounded by dirt". Not that it was very easy to be certain about the dirt, which had to accumulate

for a considerable time before it showed against Jeff's normal sunburn.
By turns he could be affectionate or morose, reserved or ebullient. He showed no preference for one parent rather than the other, and the arrival of his little sister had not produced any signs of jealousy. His medical card was spotless; he had never had a day's illness in his life. But in these times, and in such a climate, there was nothing unusual about this.
Unlike some boys, Jeff did not grow quickly bored by his father's company and desert him whenever possible for assodates of his own age. It was obvious that he shared George's artistic talents, and almost as soon as he was able to walk had become a regular back-stage visitor to the Colony's theatre, Indeed, the theatre had adopted him as an unofficial mascot and he was now highly skilled at presenting bouquets to visiting celebrities of stage and screen.
Yes, Jeff was a perfectly ordinary boy. So George reassured himself as they went for walks or rides together over the Island's rather restricted terrain. They would talk as sons and fathers had done since the beginning of time-except that in this age there was so much more to talk about. Though Jeff never left the Island, he could see all that he wished of the surrounding world through the ubiquitous eye of the television screen. He felt, like all the Colonists, a slight disdain for the rest of mankind. They were the elite, the vanguard of progress. They would take Mankind to the heights that the Overlords had reached-and perhaps beyond. Not tomorrow, certainly, but otie day.
They never guessed that that day would be all too soon.

18

T~ dreams began six weeks later.

In the darkness of the sub-tropical night, George Greggson swam slowly upwards towards consciousness. He did not know what had awakened him, and for a moment he lay in a puzzled stupor. Then he realized that he was alone. Jean had got up and gone silently into the nursery. She was talking quietly to Jeff, too quietly for him to hear what she was saying.

George heaved himself out of bed and went to join her. The Poppet had made such nocturnal excursions common enough, but then there had been no question of his remaining asleep through the uproar. This was something quite different and he wondered what had disturbed Jean.

The only light in the nursery came from the fluoro-paint patterns on the walls. By their dim glow, George could see Jean sitting beside Jeff's bed. She turned as he came in, and whispered, "Don't disturb the Poppet."

"What's the matter?"

"I knew that Jeff wanted me, and that woke me up."

The very matter-of-fact simplicity of that statement gave George a feeling of sick apprehension. "I knew that Jeff wanted me." How did you know? he wondered. But all. he asked was:

"Has he been having nightmares?"

"I'm not sure," said Jean, "he seems all right now. But he was frightened when I came in."

"I wasn't frightened, Mummy," came a small, indignant voice. "But it was such a strange place."

"What was?" asked George. "Tell me all about it."

"There were mountains," said Jeff dreamily. "They were ever so high and there was no snow on them, like on all the mountains I've ever seen. Some of them were burning."

"You mean-volcanoes ?"

"Not really. They were burning all over, with funny blue flames. And while I was watching, the sun came up."

"Go on-why have you stopped?"

Jeff turned puzzled eyes towards his father.

"That's the other thing I don't understand, Daddy. It came up so quickly, and it was much too big. And-it wasn't the right colour. It was such a pretty blue."

There was a long, heart-freezing silence. Then George said quietly, "Is that all?"

"Yes. I began to feel kind of lonely, and that's when Mummy came and woke me up."

George tousled his son's untidy hair with one hand, while tightening his dressing-gown around him with the other. He felt suddenly very cold and very small. But there was no hint of this in his voice when he spoke to Jeff.

"It's just a silly dream: you've eaten too much for supper. Forget all about it and go back to sleep, there's a good boy."

"I will, Daddy," Jeff replied. He paused for a moment, then added thoughtfully, "I think I'll try and go there again."

"A blue sun?" said Karellen, not many hours later. "That must have made identification fairly easy."

"Yes," Rashaverak answered. "It is undoubtedly Aiphanidon 2. The Sulphur Mountains confirm the fact. And it's interesting to notice the distortion of the time scale. The planet rotates fairly slowly, so he must have observed many hours in a few minutes."

"That's all you can discover?"

"Yes, without questioning the child directly."

"We dare not do that. Events must take their natural course without our interference. When his parents approach us- then, perhaps, we can question him."
"They may never come to us. And when they do, it may be too late."
"That, I am afraid, cannot be helped. We should never forget this fact-that in these matters our curiosity is of no importance. It is no more important, even, than the happiness of mankind."
His hand reached out to break the connection.
"Continue the surveillance, of course, and report all results to me. But do not interfere in any way."

Yet when he was awake, Jeff still seemed just the same.
That at least, thought George, was something for which they could be thankful. But the dread was growing in his heart.
To Jeff~ it was only a game: it had not yet begun to frighten him. A dream was merely a dream, no matter how strange it might be. He was no longer lonely in the worlds that sleep opened up to him. Only on that first night had his mind called out to Jean across whatever unknown gulfs had sundered them.
Now he went alone and fearless into the universe that was opening up before him. In the mornings they would question him, and he would tell what he could remember. Sometimes his words stumbled and failed as he tried to describe scenes which were clearly not only beyond all his experience, but beyond the imagination of Man. They would prompt him with new words, show him pictures

and colours to refresh his memory, then build up what pattern they could from his replies. Often they could make nothing of the result, though it seemed that in Jeft's own mind his dream worlds were perfectly plain and sharp. He was simply unable to communicate them to his parents. Yet some were clear enough- Space-no planet, no surrounding landscape, no world underfoot. Only the stars in the velvet night, and hanging against them a great red sun that was beating like a heart.
Huge and tenuous at one moment, it would slowly shrink, brightening at the same time as if new fuel was being fed to its internal fires. It would climb the spectrum and hover at the edge of yellow, and the cycle would reverse itself, the, star would expand and cool, becoming once more a ragged, flame-red cloud....
("Typical pulsating variable," said Rashaverak eagerly.
"Seen, too, under tremendous time-acceleration. I can't identify it precisely, but the nearest star that fits the description is Rhamsandron 9. Or it may be Pharanidon 12."
"Whichever it is," replied Karellen, "he's getting further away from home."
"Much further," said Rashaverak....)

It might have been Earth. A white sun hung in a blue sky flecked with clouds, which were racing before a storm. A bill sloped gently down to an ocean torn into spray by the ravening wind. Yet nothing moved: the scene was frozen as if glimpsed in a flash of lightning. And far, far away on the horizon was something that was not of Earth-a line of misty columns, tapering slightly as they soared out of the sea and lost themselves among the clouds. They were spaced with perfect precision along the rim of the planet-too huge to be artificial, yet too regular to be natural.
("Sideneus 4 and the Pillars of the Dawn," said Rashaverak, and there was awe in his voice. "He has reached the centre of the Universe."
"And he has barely begun his journey," answered Karellen.)

The planet was absolutely flat. Its enormous gravity had long ago crushed into one uniform level the mountains of its fiery youth-mountains whose mightiest peaks had never exceeded a few metres in height. Yet there was life here, for the surface was covered with a myriad geometrical patterns that crawled and moved and changed their colour. It was a world of two dimensions, inhabited by beings ~who could be no more than a fraction of a centimetre in thickness.
And in its sky was such a sun as no opium eater could have imagined in his wildest dreams. Too hot to be white, it was a searing ghost at the frontiers of the ultra-violet, burning its planets with radiations which would be instantly lethal to all earthly forms of life. For millions of kilometres around extended great veils of gas and dust, fluorescing in countless colours as the blasts of ultra-violet tore through them. It was a star against which Earth's pale sun would have been as feeble as a glow-worm at noon.
("Hexanerax 2, and nowhere else in the known universe," said Rashaverak. "Only a handful of our ships have ever reached it-and they have never risked any landings, for who would have thought that life could exist on such planets?"
"It seems," said Karellen, "that you scientists have not been as thorough as you had believed. If those-patterns.--are intelligent, the problem of communication will be interesting. I wonder if they have any knowledge of the third dimension?")

It was a world that could never know the meaning of night and day, of years or seasons. Six coloured suns shared its sky, so that there came only a change of light, never darkness.
Through the clash and tug of conflicting gravitational flelds~ the planet travelled along the loops and curves of its inconceivably complex orbit, never retracing the same path. Ever) moment was unique: the configuration which the six suns now held in the heavens would not repeat itself this side of eternity.
And even here there was life. Though the planet might be scorched by the central fires in one age, and frozen in the outer reaches in another, it was yet the home of intelligence. The great, many-faceted crystals stood grouped in intricate geometrical patterns, motionless in the eras of cold, growing slowly along the veins of mineral when the world was warm

again. No matter if it took a thousand years fbr them to complete a thought. The universe was still young, and Time stretched endlessly before them- ("I have searched all our records," said Rashaverak. "We
have no knowledge of such a world, or such a combination of suns. If it existed inside our universe, the astronomers would have detected it, even if it lay behind the range of our ships."
"Then he has left the Galaxy."
"Yes. Surely it cannot be much longer now."
"Who knows? He is only dreaming. When he awakes, he is still the same. It is merely the first phase. We will know soon enough when the change begins.")

'We have met before, Mr. Greggson," said the Overlord gravely. "My name is Rashaverak. No doubt you remember."
"Yes," said George. "That party of Rupert Boyce's. I am not likely to forget. And I thought we should meet again."
"Tell me-why have you asked fbr this interview?"
"I think you already know."
"Pernaps: but it will help us both if you tell me in your own words. It may surprise you a good deal, but I also am trying to understand, add in some ways my ignorance is as great as yours."

George stared at the Overlord in astonishment. l'his was a thought that had never occurred to him. He had subconsciously assumed that the Overlords possessed all knowledge and all power-that they understood, and were probably responsible fbr, the things that had been happening to Jeff.
"I gather," George continued, "that you have seen the reports I gave to the Island psychologist, so you know about the dreams."
"Yes: we know about them."
"I never believed that they were simply the imaginings of a child. They were so incredible that-I know this sounds ridiculous-they had to be based on some reality."
He looked anxiously at Rashaverak, not knowing whether to hope for confirmation or denial. The Overlord said nothing, but merely regarded him with his great calm eyes. They were sitting almost face to face, for the room-which had obviously been designed for such interviews-was on two levels, the

Overlord's massive chair being a good metre lower than George's. It was a friendly gesture, reassuring to the men who asked for these meetings and who were seldom in an easy frame of mind.
"We were worried, but not really alarmed at first. Jeff seemed perfectly normal when he woke up, and his dreams didn't appear to bother him. And then one night"-he hesitated and glanced defensively at the Overlord. "I've never believed in the supernatural: I'm no scientist, but I think there's a rational explanation for everything."
"There is," said R.ashaverak. "I know what you saw: I was watching."
"I always suspected it. But Karellen had promised that you'd never spy on us with your instruments. Why have you broken that promise?"
"I have not broken it. The Supervisor said that the human race would no longer be under surveillance. That is a promise we have kept. I was watching your children, not you."
It was several seconds before George understood the implications of Rashaverak's words. Then the colour drained slowly from his face.
"You mean?. . ." he gasped. His voice trailed away and he had to begin again. "Then what in God's name are my children?"
"That," said Rashaverak solemnly, "is what we are trying to discover."

Jennifer Anne Greggson, lately known as the Poppet, lay on her back with her eyes tightly closed. She had not opened them for a long time; she would never open them again, for sight was now as superfluous to her as to the many-sensed creatures of the lightless ocean deeps. She was aware of the world that surrounded her: indeed, she was aware of much more than that.
One reflex remained from her brief babyhood, by some unaccountable trick of development. The rattle which had once delighted her sounded incessantly now, beating a complex, ever-changing rhythm in her cot. It was that strange syncopadon which had amused Jean from her sleep and sent her flying Into the nursery. But it was not the sound alone that had started her screaming for George.
It was the sight of that commonplace, brightly coloured

rattle beating steadily in airy isolation half a metre away from any support, while Jennifer Anne, her chubby fingers clasped tightly together, lay with a smile of calm contentment on her face.
She had started later, but she was progressing swiftly. Soon she would pass her brother, for she had so much less to unlearn.

"You were wise," said Rashaverak, "not to touch her toy. I do not believe you could have moved it. But if you had
succeeded, she might have been annoyed. And then, I do not

know what would have happened."
"Do you mean," said George dully, "that you can do nothing?"
"I will not deceive you. We can study and observe, as we are doing already. But we cannot interfere, because we cannot
understand."
"Then what are we to do? And why has this thing happened to us?"
"It had to happen to someone. There is nothing exceptional about you, any more than there is about the first neutron that starts the chain reaction in an atomic bomb. It simply happens to be the first. Any other neutron would have served-just as Jeffrey might have been anybody in the world. We call it Total Breakthrough. There is no need for any secrecy now, and I am very glad. We have been waiting for this to happen, ever since we caine to Earth. There was no way of telling when and where it would start-until, by pure chance, we met at Rupert Boyce's party. TheLi I knew that, almost certainly, your wife's children would be the first."
"But-we weren't married then. We hadn't even-"
"Yes, I know. But Miss Morrel's mind was the channel that, if only for a moment, let through knowledge which no-one alive at that time could possess. It could only come from another mind, intimately linked to hers. The fact that it was a mind not yet born was of no consequence, for Time is very much stranger than you think."
"I begin to understand. Jeff knows these things-he can see other workis, and can tell where you come from. And somehow Jean caught his thoughts, even before he was born."
"There is far more to it than that-but I do not 1ni~gine you will ever get much closer to the truth. All through history

there have been people with inexplicable powers which seemed to transcend space and time. They never understood them:
almost without exception, their attempted explanations were rubbish. I should know-I have read enough of them!
"But there is one analogy which is-well, suggestive and helpful. It occurs over and over again in your literature. Imagine that every man's mind is an island, surrounded by ocean. Each seems isolated, yet in reality all are linked by the bedrock from which they spring. If the oceans were to vanish, that would be the end of the islands. They would all be part of one continent, but their individuality would have gone.
"Telepathy, as you have called it, is something like this. In suitable circumstances minds can merge and share each other's contents, and carry back memories of the experience when they are isolated once more. In its highest form, this power is not subject to the usual limitations of time and space. That is why Jean could tap the knowledge of her unborn son."
There was a long silence while George wrestled with these astounding thoughts. The pattern was beginning to take shape. It was an unbelievable pattern, but it had its own inherent logic. And it explained-if the word could be used fur anything so incomprehensible-all that had happened since that evening at Rupert Boyce's home. It also accounted, he realized now, for Jean's own curiosity about the supernormal.
"What has started this thing?" asked George. "And where is it going to lead?"
"That is something we cannot answer. But there are many races in the universe, and some of them discovered these powers long before your species-or mine-appeared on the scene. They have been waiting for you to join them, and now the time has come."
"Then where do you come into the picture?"
"Probably, like most men, you have always regarded us as your masters. That is not true. We have never been more than guardians, doing a duty imposed upon us from-above.

That duty is hard to define: perhaps you can best think of us as midwives attending a difficult birth. We are helping to bring something new and wonderful into the world."
Rashaverak hesitated: for a moment it almost seemed as if he was at a loss for words.
"Yes, wc are the midwives. But we ourselves are barren."
In that instant, George knew he was in the presence of a
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tragedy transcending his own. It was incredible-and yet somehow just. Despite all their powers and their brilliance, the Overlords were trapped in some evolutionary cul-de-sac. Here was a great and noble race, in almost every way superior to mankind; yet it had no future, and it was aware of it. In the face of this, George's own problems seemed suddenly trivial.
"Now I know," he said, "why you have been watching Jeffrey. He was the guinea pig in this experiment."
"Exactly-though the experiment was beyond our control.
We did not start it-we were merely trying to observe. We did not interfere except when we had to."
Yes, thought George-the tidal wave. It would never do to let a valuable specimen be destroyed. Then he felt ashamed of himself: such bitterness was unworthy.
"I've only one more question," he said. "What shall we do about our children?"
"Enjoy them while you may," answered Rashaverak gently. "They will not be yours for long."
It was advice that might have been given to any parent in any age: but now it contained a threat and a terror it had never held before.

19

TIiaRJ~ came the time when the world of Jeffrey's dreams was no longer sharply divided from his everyday existence. He no longer went to school, and for Jean and George also the routine of life was completely broken, as it was soon to break down throughout the world.
They avoided all their friends, as if already conscious that soon no-one would have sympathy to spare for them. Sometimes, in the quietness of the night when there were few people about, they would go for long walks together. They were closer now than they had been since the first days of their marriage, united again in the face of the still unknown tragedy that soon would overwhelm them.
At first it had given them a feeling of guilt to leave the sleeping children alone in the house, but now they realized that Jeff and Jenny could look after themselves in ways. beyond the knowledge of their parents. And, of course, the Overlords
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would be watching too. That thought was reassuring: they felt that they were not alone with their problem, but that wise and sympathetic eyes shared their vigil.
Jennifer slept: there was no other word to describe the state she had entered. To all outward appearances, she was still a baby, but round her now was a sense of latent power so terrifying that Jean could no longer bear to enter the nursery.
There was no need to do so. The entity that had been Jennifer Anne Greggson was not yet fully developed, but even in its sleeping chrysalis state it already had enough control of its environment to take care of all its needs. Jean had only once attempted to feed it, without success. It chose to take nourishment in its own time, and in its own manner.
For food vanished from the freezer in a slow, steady stream:
yet Jennifer Anne never moved from her cot.

The rattling had ceased, and the discarded toy lay on the nursery floor where no-one dared to touch it, lest Jennifer Anne might need it again. Sometimes she caused the furniture to stir itself into peculiar patterns, and it seemed to George that the fluoro-paint on the wall was glowing more brilliantly than it had ever done before.

She gave no trouble; she was beyond their assistance, and beyond their love. It could not last much longer, and in the time that was left they clung desperately to Jeff.

He was changing too, but he still knew them. The boy whose growth they had watched from the formless mists of babyhood was losing his personality, dissolving hour by hour before their very eyes. Yet sometimes he still spoke to them as he had always done, and talked of his toys and friends as if unconscious of what lay ahead. But much of the time he did not see them, or show any awareness of their presence. He no longer slept, as they were forced to do, despite their overwhelming need to waste as few as possible of these last remaining hours.

Unlike Jenny, he seemed to possess no abnormal powers over physical objects-perhaps because, being already partly grown, he had less need for them. His strangeness was entirely in his mental life, of which the dreams were now only a small part. He would stay quite still for hours on end, his eyes tightly closed, as if listening to sounds which no-one else could hear. Into his mind was flooding knowledge-from somewhere or somewhen-which soon would overwhelm and

destroy the half-formed creature who had been Jeffrey Angus Greggson.

And Fey would sit watching, looking up at him with tragic, puzzled eyes, wondering where her master had gone and when he would return to her.

Jeff and Jenny had been the first in all the world, but soon they were no longer alone. Like an epidemic spreading swiftly from land to land, the metamorphosis infected the entire human race. It touched practically no-one above the age of ten, and practically no-one below that age escaped.

It was the end of civilization, the end of all that men had striven for since the beginning of time. In the space of a few days, humanity had lost its future, for the heart of any race is destroyed, and its will to survive is utterly broken, when its children are taken from it.

There was no panic, as there would have been a century before. The world was numbed, the great cities stilled and silent. Only the vital industries continued to function. It was as though the planet was in mourning, lamenting all that now could never be.

And then, as he had done once before in a now-forgotten age, Karellen spoke for the last time to mankind.

20

"My work here Is nearly ended," said Karellen's voice from a million radios. "At last, after a hundred years, I can tell you what it was.

"There are many things we have had to hide from you, as we hid ourselves for half our stay on Earth. Some of you, I know, thought that concealment unnecessary. You are accustomed to our presence: you can no longer imagine how your ancestors would have reacted to us. But at least you can understand the purpose of our concealment, and know that we had a reason for what we did.

"The supreme secret we kept from you was our purpose in coming to Earth-that purpose about which you have speculated so endlessly. We could not tell you until now, for the secret was not ours to reveal.

"A century ago we came to your world and saved you from self-destruction. I do not believe that anyone would deny that fact-but what that self~~destruction was, you never guessed.
"Because we banned nuclear weapons and all the other deadly toys you were accumulating in your armouries, the danger of physical annihilation was removed. You thought that was the only danger. We wanted you to believe that, but it was never true. The greatest danger that confronted you was of a different character altogether-and it did not concern your race alone.
"Many worlds have come to the crossroads of nuclear power, have avoided disaster, have gone on to build peaceful and happy civilizations-and have then been utterly destroyed by forces of which they knew nothing. In the twentieth century, you first began to tamper seriously with those forces.
That was why it became necessary to act.
"All through that century, the human race was drawing slowly nearer to the abyss-never even suspecting its existence. Across that abyss, there is only one bridge. Few races, unaided, have ever found it. Some have turned back while there was still time, avoiding both the danger and the achievement. Their worlds have become Elysian islands of effortless content, playing no further part in the story of the universe. That would never have been your fate-or your fortune. Your race was too vital for that. It would have plunged into ruin and taken others with it, for you would never have found the bridge.
"I am afraid that almost all I have to say now must be by means of such analogies. You have no words, no conceptions, for many of the things I wish to tell you-and our own knowledge of them is also sadly imperfect.
"To understand, you must go back into the past and recover much that your ancestors would have found familiar, but which you have forgotten-which, in fact, we deliberately helped you to forget. For all our sojourn here has been based on a vast deception, a concealment of truth which you were not ready to face.
"In the centuries before our coming, your scientists uncovered the secrets of the physical world and led you from the energy of steam to the energy of the atom. You had put superstition behind you: Science was the only real religion of mankind. It was the gift of the western minority to the remainder

of mankind, and it had destroyed all other faiths. Those that still existed when we came were already dying. Science, it was felt, could explain everything: there were no forces which did not come within its scope, no events for which it could not ultimately account. The origin of the universe might be forever unknown, but all that had happened after obeyed the laws of physics.
"Yet your mystics, though they were lost in their own delusions, had seen part of the truth. There are powers of the mind, and powers beyond the mind, which your science could never have brought within its framework without shattering it entirely. All down the ages there have been countless reports of strange phenomena-poltergeists, telepathy, precognition-which you had named but never explained. At first Science ignored them, even denied their existence, despite the testimony of five thousand years. But they exist and if it isto be complete any theory of the universe must account for them.
"During the first half of the twentieth century, a few of your scientists began to investigate these matters. They did not know it,but they were tampering with the lock of Pandora's box. The forces they might have unleashed transcended any perils that the atom could have brought. For the physicists could only have ruined the Earth: the paraphysicists could have spread havoc to the stars.
"That could not be allowed. I cannot explain the full nature of the threat you represented. It would not have been a threat to us, and therefore we do not comprehend it. Let us say that you might have become a telepathic cancer, a malignant mentality which in its inevitable dissolution would have poisoned other and greater minds.

"And so we came-we were sent-to Earth. We interrupted your development on every cultural level, but in particular we checked all serious work on paranormal phenomena. I am well aware of the fact that we have also inhibited, by the contrast between our civilizations, all other forms of creative achievement as well. But that was a secondary effect, and it is of no Importance.
"Now I must tell you something which you may find very surprising, perhaps almost incredible. All these potentialities, all these latent powers-we do not possess them, nor do we understand them. Our intellects are far more powerful than
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yours, but there is something in your minds that has always eluded us. Ever since we came to Earth we have been studying you; we have learned a great deal, and will learn more, yet I doubt if we shall discover all the truth.
"Our races have much in common-that is why we were chosen for this task. But in other respects, we represent the ends of two different evolutions. Our minds have reached the end of their development. So, in their present form, have yours. Yet you can make the jump to the next stage, and therein lies the difference between us. Our potentialities are exhausted, but yours are still untapped. They are linked, in ways we do not understand, with the powers I have mentioned- the powers that are now awakening on your world.
"We held the clock back, we made you mark time while those powers developed, until they could come flooding out into the channels that were being prepared for them. What we did to improve your planet, to raise your standards of living, to bring justice and peace-those things we should have done in any event, once we were forced to intervene in your affairs. But all that vast transformation diverted you from the truth, and therefore helped to serve our purpose.
"We are your guardians-no more. Often you must have wondered what position my race held in the hierarchy of the universe. As we are above you, so there is something above us, using us for its own purposes. We have never discovered what it is, though we have been its tool for ages and dare not disobey it. Again and again we have received our orders, have gone to some world in the early flower of its civilization, and have guided it along the road that we can never follow- the road that you are travelling now.
"Again and again we have studied the process we have been sent to foster, hoping that we might learn to escape from our own limitations. But we have glimpsed only the vague outlines of the truth. You called us the Overlords, not knowing the irony of that title. Let us say that above us is the Over-mind, using us as the potter uses his wheel.
"And your race is the clay that is being shaped on that
wheel.
"We believe-it is only a theory-that the Overmind Is trying to grow, to extend its powers and its awareness of the universe. By now it must be the sum of many races, and long ago it left the tyranny of matter behind. It is conscious of
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intelligence, everywhere. When it knew that you were almost ready, it sent us here to do its bidding, to prepare you for the transformation that is now at hand.
"All the earlier changes your race has known took countless ages. But this is a transformation of the mind, not of the body. By the standards of evolution, it will be cataclysmic-instantaneous. It has already begun. You must face this thct: yours is the last generation of Homo sapiens.
"As to the nature of that change, we can tell you very little. We do not know how it is produced-what trigger impulse the Overmind employs when it judges that the time is ripe. All we have discovered is that it starts with a single individual- always a ~child-and then spreads explosively, like the formation of crystals round the first nucleus in a saturated solution. Adults will not be affected, for their minds are already set in an unalterable mould.

"In a few years, it will all be over, and the human race will have divided in twain. There is no way back, and no future for the world you know. All the hopes and dreams of your race are ended now. You have given birth to your successors, and it is your tragedy that you will never understand them-will never even be able to communicate with their minds. Indeed, they will not possess minds as you know them. They will be a single entity, as you yourselves are the sums of your myriad cells. You will not think them human, and you will be right.
"I have told you these things so that you will know what f~aces you. In a few hours, the crisis will be upon us. My task and my duty is to protect those I have been sent here to guard.
Despite their wakening powers, they could be destroyed by the multitudes around them-yes, even by their parents, when they realize the truth. I must take them away and isolate them, for their protection, and for yours. Tomorrow my ships will begin the evacuation. I shall not blame you if you try to interfere, but it will be useless. Greater powers than mine are wakening now; I am only one of their instruments.
"And then-what am I to do with you, the survivors, when your purpose has been fufilled? It would be simplest, perhaps, and most merciful, to destroy you-as you yourselves would destroy a mortally wounded pet you loved. But this I cannot do. Your future will be your own to choose in the years that are left to you. It is my hope that humanity will go to its rest in peace, knowing that it has not lived in vain.
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"For what you have brought into the world may be utterly alien, it may share none of your desires or hopes, it may look upon your greatest achievements as childish toys-yet it is something wonderful, and you will have created it.
"When our race is forgotten, part of yours will still exist. Do not, therefore, condemn us for what we were compelled to do. And remember this-we shall always envy you."

21
JEAN had wept before, but she was not weeping now. The island lay golden in the heartless, unfeeling sunlight as the ship came slowly into sight above the twin peaks of Sparta. On that rocky island, not long ago, her son had escaped death by a miracle she now understood all too well. Sometimes she wondered if it might not have been better had the Overlords stood aside and left him to his fate. Death was something she could face as she had faced it before: it was in the natural order of things. But this was stranger than death-and more final. Until this day, men had died, yet the race had continued.
There was no sound or movement from the children. They stood in scattered groups along the sand, showing no more interest in one another than in the homes they were leaving forever. Many carried babies who were too small to walk-or who did not wish to assert the powers that made walking unnecessary. For surely, thought George, if they could move inanimate matter, they could move their own bodies. Why, indeed, were the Overlord ships collecting them at all?
It was of no importance. They were leaving, and this was the way they chose to go. Then George realized what it was that had been teasing his memory. Somewhere, long ago, he had seen a century-old newsreel of such an exodus. It must have been at the beginning of the First World War-or the Second. There had been long lines of trains, crowded with cl~ildren, pulling slowly out of the threatened cities, leaving behind the parents that so many of them would never see again. Few were crying: some were puzzled, clutching nervously at their small belongings, but most seemed to be looking forward with eagerness to some great adventure.
And yet-the analogy was false. History never repeated

itself. These who were leaving now were no longer children, whatever they might be. And this time there would be no
reunion.
The ship had grounded along the water's edge, sinking deeply into the soft sand. In perfect unison, the line of great curving panels slid upwards and the gangways extended themselves towards the beach like metal tongues. The scattered, unutterably lonely figures began to converge, to gather into a crowd that moved precisely as a human crowd might do.
Lonely? Why had he thought that, wondered George. For that was the one thing they could never be again. Only individuals can be lonely-only human beings. When the barriers were down at last, loneliness would vanish as personality faded. The countless raindrops would have merged into the ocean.
He felt Jean's hand increase its pressure on his in a sudden spasm of emotion. "Look," she whispered. "I can see Jeff. By that second
door."
It was a long way away, and very hard to be certain. There was a mist before his eyes which made it hard to see. But it was Jeff-he was sure of that: George could recognize his son now, as he stood with one foot already on the metal gangway.
And Jeff turned and looked back. His face was only a white blur: at this distance, there was no way of telling if it bore any hint of recognition, any remembrance for all that he was leaving behind. Nor would George ever know if Jeff had turned towards them by pure chance-or if he knew, in those last moments while he was still their son, that they stood watching him as he passed into the land that they could never enter.
The great doors began to close. And in that moment Fey lifted up her muzzle and gave a low, desolate moan. She turned her beautiful limpid eyes towards George, and he knew that she had lost her master. He had no rival now.

For those who were left there were many roads but only one destination. There were some who said: "The world is still beautiful: one day we must leave it, but why should we hasten our departure?"
But others, who had set more store by the future than the

past, and had lost all that made life worth living, did not wish to stay. They took their leave alone, or with their friends, according to their nature.
It was thus with Athens. The Island had been born in fire; in fire it chose to die. Those who wished to leave did so, but most remained, to meet the end amid the broken fragments of their dreams.

No-one was supposed to know when the time would be. Yet Jean awoke in the stillness of the night, and lay for a moment staring at the ghostly glimmer from the ceiling. Then she reached out to grasp George's hand. He was a sound sleeper, but this time he woke at once. They did not speak, fur the words that were wanted did not exist.
Jean was no longer frightened, or even sad. She had come through to the calm waters and was beyond emotion now. But there was one thing still to be done, and she knew that there was barely time to do it.
Still without a word, George followed her through the silent house. They went across the patch of moonlight that had entered through the studio roof, moving as quietly as the shadows it cast, until they came to the deserted nursery. Nothing had been changed. The fluoro-patterns that George had painted so carefully still glowed on the walls. And the rattle that had once belonged to

Jennifer Anne still lay where she had dropped it, when her mind turned into the unknowable remoteness it inhabited now.
She bad left her toys behind, thought George, but ours go hence with us. He thought of the royal children of the Pharaohs, whose dolls and beads had been buried with them five thousand years ago. So it would be again. No-one else, he told himsel4 will ever love our treasures: we will take them with us, and will not part with them.
Slowly Jean turned towards him, and rested her head upon his shoulder. He clasped his arms about her waist, and the love he had once known came back to him, faint yet clear, like an echo from a distant range of hills. It was too late now to say all that was due to her, and the regrets he felt were less for his deceits than for his past indifference.
Then Jean said quietly: "Goodbye, my darling" and
tightened her arms about him. There was no time for George

I
to answer, but even at that final moment he felt a brief astonishment as he wondered how she knew that the moment had arrived.
Far down in the rock, the segments of uranium began to rush together, seeking the union they could never achieve.
And the Island rose to meet the dawn.

22
Tiis ship of the Overlords came sliding In along its glowing meteor-trail through the heart of Carina. It had begun its mad deceleration among the outer planets, but even while passing Mars it had still possessed an appreciable fraction of the velocity of light. Slowly the immense fields surrounding the Sun were absorbing its momentum, while for a million kilometres behind, the stray energies of the Stardrive were painting the heavens with fire.
Jan Rodricks was coming home, six months older, to the world he had left eighty years before.
This time he was no longer a stowaway, hidden in a secret chamber. He stood behind the three pilots (why, he wondered, did they need so many?) watching the patterns come and go~ on the great screen that dominated the control room. The colours and shapes it showed were meaningless to him:,he assumed that they were conveying information which in a vessel designed by men would have been displayed on banks of meters. But sometimes the screen showed the surrounding star-fields, and soon, he hoped, it would be showing Earth.
He was glad to be home, despite the effort he had devoted to escaping from it. In these few months he had grown up. He had seen so much, travelled so far, and now was weary for his own familiar world. He understood, now, why the Overlords had sealed Earth from the stars. Humnriity still had very far to go before it could play any part in the civilization he had glimpsed.
It might be-though this he refused to accept-that mankind could never be more than an inferior species, preserved in an out-of-the-way zoo with the Overlords as keepers. Perhaps that was what Vindarten bad meant when he gave Jan that ambiguous warning, just before his departure. "Much

may have happened," the Overlord had said, "in the time that
has passed on your planet. You may not know your world
when you see it again."
Perhaps not, thought Jan: eighty years was a long time, and though he was young and adaptable, he might find it hard to understand all the changes that had come to pass. But of one thing he was certain-men would want to hear his story, and to know what he had glimpsed of the civilization of the Overlords.

They had treated him well, as he had assumed they would. Of the outward journey he had known nothing: when the injection had worn off and he had emerged, the ship was already entering the Overlord system. He had climbed out of his fantastic hiding-place, and found to his relief that the oxygen set was not needed. The air was thick and heavy, but he could breathe without difficulty. He had found himself in the ship's enormous red-lit hold, among countless other packing-cases and all the impedimenta one would expect on a liner of space or of sea. It had taken him almost an hour to find his way to the control room and to introduce himself to the crew.

Their lack of surprise had puzzled him: he knew that the Overlords showed few emotions, but he had expected some reaction. Instead, they simply continued with their work, watching the great screen and playing with the countless keys on their control panels. It was then that he knew that they were landing, for from time to time the image of a planet- larger at each appearance-would flash upon the screen.

Yet there was never the slightest sense of motion or acceleration-only a perfectly constant gravity, which he judged to be about a fifth of Earth's. The immense forces that drove the ship must have been compensated with exquisite precision.

And then, in unison, the three Overlords had risen from their seats, and he knew that the voyage was over. They did not speak to their passenger or to each other, and when one of them beckoned to him to follow, Jan realized something that he should have thought of before. There might well be no-one here, at this end of Karellen's enormously long supply line, who understood a word of English.

They watched him gravely as the great doors opened before his eager eyes. This was the supreme moment of his life: now he was to be the first human being ever to look upon a world lit by another sun. The only light of NGS 549672 came

flooding into the ship, and there before him lay the planet of the Overlords.

What had he expected? He was not sure. Vast buildings, cities whose towers were lost among the clouds, machines beyond imagination- these would not have surprised him.

Yet what he saw was an almost featureless plain, reaching out to an unnaturally close horizon, and broken only by three more of the Overlords' ships, a few kilometres away.

For a moment Jan felt a surge of disappointment. Then he shrugged his shoulders, realizing that, after all, one would expect to find a space-port in some such remote and uninhabited region as this.

It was cold, though not uncomfortably so. The light from the great red sun low down on the horizon was quite ample for human eyes, but Jan wondered how long it would be before he yearned for greens and blues. Then he saw that enormous, wafer-thin crescent reaching up the sky like a great bow placed beside the sun. He stared at it for a long time before he realized that his journey was not yet altogether ended. That was the world of the Overlords. This must be its satellite, merely the base from which their vessels operated.

They had taken him across in a ship no larger than a terrestrial airliner. Feeling a pygmy, he had climbed up into one of the great seats to try and see something of the approaching planet through the observation windows.

The journey was so swift that he had time to make out few details on the expanding globe beneath. Even so near to home, it seemed, the Overlords used some version of the Stardrive, for in a matter of minutes they were falling down through a deep, cloud-flecked atmosphere. When the doors opened, they stepped out into a vaulted chamber with a roof that must have swung swiftly shut behind them, for there was no sign of any entrance overhead.

It was two days before Jan left this building. He was an unexpected consignment, and they had nowhere to put him. To make matters worse, not one of the Overlords could understand English. Communication was practically

impossible, J and Jan realized bitterly that getting in touch with an alien race was not so easy as it was so often depicted in fiction. Sign language proved singularly unsuccessful, for it depended too much on a body of gestures, expressions and attitudes which the Overlords and mankind did not possess in common.
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It would be more than frustrating, thought Jan, if the only Overlords who spoke his language were all back on Earth. He could only wait and hope for the best. Surely some scient1st, some expert on alien races, would come and take charge of him! Or was he so unimportant that no-one could be bothered?
There was no way he could get out of the building, because the great doors had no visible controls. When an Overlord walked up to them, they simply opened. Jan had tried the same trick, had waved objects high in the air to interrupt any controlling light-beam, had tried everything he could imagine
-with no result at all. He realized that a man from the Stone Age, lost in a modern city building, might be equally helpless. Once he had tried to walk out when one of the Overlords left, but had been gently shooed back. As he was very anxious not to annoy his hosts, he did not persist.
Vindarten arrived before Jan had begun to get desperate.
The Overlord spoke very bad English, much too rapidly, but improved with amazing speed. In a few days they were able to talk together with little trouble on any subject that did not demand a specialized vocabulary.
Once Vindarten had taken charge of him, Jan had no more worries. He also had no opportunity of doing the things he wished, for almost all his time was spent meeting Overlord scientists anxious to carry Out obscure tests with complicated instruments. Jan was very waxy of these machines, and after one session with some kind of hypnotic device had a splitting headache for several hours. He was perfectly willing to cooperate, but was not sure if his investigators realized his limitations, both mental and physical. It was certainly a long time before he could convince them that he had to sleep at regular intervals.
Between these investigations, he caught momentary glimpses of the city, and realized how difficult-and dangerous-it would be for him to travel around in it. Streets were practically non-existent, and there seemed to be no surface transport. This was the home of creatures who could fly, and who had no fear of gravity. It was nothing to come without warning upon a vertiginous drop of several hundred metres, or to find that the only entrance into a room was an opening high up in the wall. In a hundred ways, Jan began to realize that the psychology of a race with wings must be fundamentally different from that of earthbound creatures.
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It was strange to see the Overlords flying like great birds
among the towers of their city, their pinions moving with slow, powerful beats. And there was a scientific problem here.
This was a large planet-larger than Earth. Yet its gravity was low, and Jan wondered why it had so dense an atmosphere. He questioned Vindarten on this, and discovered, as he had half expected, that this ~was not the original planet of the Overlords. They had evolved on a much smaller world and then conquered this one, changing not only its atmosphere but even its gravity.
The architecture of the Overlords was bleakly functional:
Jan saw no ornaments, nothing that did not serve a purpose, even though that purpose was often beyond his understanding. If a man from mediaval times could have seen this red-lit city, and the beings moving through it, he would certainly have believed himself in Hell. Even Jan, for all his curiosity and scientific detachment, sometimes found himself on the verge of unreasoning terror. The absence of a single familiar reference point can be utterly unnerving even to the coolest and clearest minds.

And there was much he did not understand, and which Vindarten could or would not attempt to explain. What were those flashing lights and changing shapes, the things that flickered through the air so swiftly that he could never be certain of their existence? They could have been something tremendous and awe-inspiring--or as spectacular yet trivial as the neon signs of old-time Broadway.

Jan also sensed that the world of the Overlords was full of sounds that he could not hear. Occasionally he caught complex rhythmical patterns racing up and down through the audible spectrum, to vanish at the upper or lower edge of hearing. Vindarten did not seem to understand what Jan meant by music, so he was never able to solve this problem to his satisfaction.

The city was not very large: it was certainly far smaller then London or New York had been at their heyday. According to Vindarten, there were several thousand such cities scattered over the planet, each one designed for some specific purpose. On Earth, the closest parallel to this place would have been a university town-except that the degree of specialization had gone much further. This entire city was devoted, Jan soon discovered, to the study of alien cultures.

In one of their first trips outside the bare cell in which Jan lived, Vindarten had taken him to the museum. It had given Jan a much needed psychological boost to find himself in a place whose purpose he could fully understand. Apart from the scale upon which it was built, this museum might well have been on Earth.

They had taken a long time to reach it, falling steadily on a great platform that moved like a piston in a vertical cylinder of unknown length. There were no visible controls, and the sense of acceleration at the beginning and ending of the descent was quite noticeable. Presumably the Overlords did not waste their compensating field devices for domestic uses. Jan wondered if the whole interior of this world was riddled with excavations: and why had they limited the size of the city, going underground instead of outwards? That was just another of the enigmas he never solved.

One could have spent a lifetime exploring these colossal chambers. Here was the loot of planets, the achievements of more civilizations than Jan could guess. But there was no time to see much. Vindarten placed him carefully on a strip of flooring that at first sight seemed an ornamental pattern. Then Jan remembered that there were no ornaments here- and at the same time, something invisible grasped him gently and hurried him forward. He was moving past the great display cases, past vistas of unimaginable worlds, at a speed of twenty or thirty kiometres an hour.

The Overlords had solved the problem of museum fatigue.

There was no need for anyone to walk.

They must have travelled several kilometres before Jan's guide grasped him again, and with a surge of his great wings lifted him away from whatever force was propelling them. Before them stretched a huge, half-empty hail, flooded with a familiar light that Jan had not seen since leavng Earth. It was flint, so that it would not pain the sensitive eyes of the Overlords, but it was, unmistakably, sunlight. Jan would never have believed that anything so simple or so commonplace could have evoked such yearning in his heart.

So this was the exhibit for Earth. They walked for a few metres past a beautiful model of Paris, past art-treasures from a dozen centuries grouped incongruously together, past modem calculating machines and paleolithic axes, past television receivers and Hero of Alexandra's steam-turbine. A

great doorway opened ahead of them, and they were in the office of the Curator for Earth.

Was he seeing a human being for the first time? Jan

wondered. Had he ever been to Earth, or was it just another of the many planets in his charge, of whose exact location he was not precisely sure? Certainly he neither spoke nor understood English, and Vindarten had to act as interpreter. Jan had spent several hours here, talking into a recording device while the Overlords presented various terrestrial
objects to him. Many of these, he discovered to his shame, he could not identif~y. His ignorance of his own race and its achievements was enormous: he wondered if the Overlords, for all their superb mental gifts, could really grasp the complete pattern of human culture.

Vindarten took him out of the museum by a different route. Once again they floated effortlessly through great vaulted corridors, but this time they were moving past the creations of nature, not of conscious mind. Sullivan, thought Jan, would have given his life to be here, to see what wonders evolution had wrought on a hundred worlds. But Sullivan, he remembered, was probably already dead.

Then, without any warning, they were on a galleiy high above a large circular chamber, perhaps a hundred metres across. As usual, there was no protective parapet, and for a moment Jan hesitated to go near the edge. But Vindarten was standing on the very brink, looking calmly downwards, so Jan moved cautiously forward to join him.

The floor was only twenty metres below-far, far too dose. Afterwards, Jan was sure that his guide had not intended to surprise him, and was completely taken aback by his reaction. For he had given one tremendous yell and jumped backwards frçm the gallery's edge, in an involuntary effort to hide what lay below. It was not until the muffled echoes of his shout had died away in the thick atmosphere that he steeled himself to go forward again.

It was lifeless, of course-not, as he had thought in that first moment of panic, consciously staring up at him. It filled almost all that great circular space, and the ruby light gleamed and shifted in its crystal depths.

It was a single giant eye.

"Why did you make that noise?" asked Vindarten.

"I was frightened," Jan confessed sheepishly.

"But why? Surely you did not imagine that there could be any danger here?"

Jan wondered if he could explain what a reflex action was,
but decided not to attempt it.

"Anything completely unexpected is frightening. Until a
novel situation is analysed, it is safest to assume the worst."

His heart was still pounding violently as he stared down once more at that monstrous eye. Of course, it might have been a model, enormously enlarged as were microbes and insects in terrestrial museums. Yet even as he asked the question, Jan knew, with a sickening certainty, that it was no larger than life. Vindarten could tell him little: this was not his field of knowledge, and he was not particularly curious. From the Overlord's description, Jan built up a picture of a cyclopean beast living among the asteroidal rubble of some distant sun, its growth uninhibited by gravity, depending for food and life upon the range and resolving power of its single eye.

There seemed no limit to what Nature could do if she was pressed, and Jan felt an irrational pleasure at discovering something which the Overlords would not attempt. They had brought a full-sized whale from Earth-but they had drawn the line at this.

And there was the time when he had gone up, endlessly up, until the walls of the elevator had faded through opalescence into a crystal transparency. He was standing, it seemed, unsupported among the uppermost peaks of the city, with

nothing to protect him from the abyss. But he felt no more vertigo than one does in an aeroplane, for there was no sense of contact with the distant ground.
He was above the clouds, sharing the sky with a few pinnacles of metal or stone. A rose-red sea, the cloud-layer rolled sluggishly beneath him. There were two pale and tiny moons in the sky, not far from the sombre sun. Near the centre of that bloated red disc was a small, dark shadow, perfectly circular. It might have been a sunspot, or another moon in transit.
Jan slowly moved his gaze along the horizon. The cloud-cover extended clear to the edge of this enormous world, but in one direction, at an unguessable distance, there was a mottled patch that might have marked the towers of another
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city. He stared at it for a long while, then continued his careful survey.
When he had turned half-circle he saw the mountain. It was not on the horizon, but beyond it-a single serrated peak, climbing up over the edge of the world, its lower slopes hidden as the bulk of an iceberg is concealed below the water-line.
He tried to guess its size, and failed completely. Even on a world with gravity as low as this, it seemed hard to believe that such mountains could exist. Did the Overlords, he wondered, sport themselves upon its slopes and sweep like eagles around those immense buttresses?
And then, slowly, the mountain began to change. When he saw it first, it was a dull and almost sinister red, with a few faint markings near its crown that he could not dearly distinguish. He was trying to focus on them when he realized that they were moving....
At first he could not believe his eyes. Then he forced himself to remember that all his preconceived ideas were worthless here: he must not let his mind reject any message his senses brought into the hidden chamber of the brain. He must not try to understand-only to observe. Understanding would come later, or not at all.
The mountain-he still thought of it as such, for there was no other word that could serve-seemed to be alive. He remembered that monstrous eye in its buried vault-but no, that was inconceivable. It was not organic life that he was watching: it was not even, be suspected, matter as he knew it.
The sombre red was brightening to an angrier hue. Streaks of vivid yellow appeared, so that for a moment Jan felt he was looking at a volcano pouring streams of lava down on to the land beneath. But these streams, as he could tell by occasional flecks and mottlings, were moving upwards.
Now something else was rising out of the ruby clouds around the mountain's base. It was a huge ring, perfectly horizontal and perfectly circular-and it was the colour of all that Jan had left so far behind, for the skies of Earth had held no lovelier blue. Nowhere else on the world of the Overlords had he seen such hues, and his throat contracted with the longing and the loneliness they evoked.
The ring was expanding as it climbed. It was higher than the mountain now, and its nearer arc was sweeping swiftly towards him. Surely, thought Jan, it must be a vortex of some
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kind-a smoke-ring already many kilometres across. But it showed none of the rotation he expected, and it seemed to grow no less solid as its size increased.
Its shadow rushed past long before the ring itself had swept majestically overhead, still rising into space. He watched until it had dwindled to a thin thread of blue, hard for the eye to focus upon in the surrounding redness of the sky. When it vanished at last, it must already have been many thousands of kilometres across. And it was still growing.
He looked back at the mountain. It was golden now, and devoid of all markings. Perhaps it was imagination-he could

believe anything by this time-but it seemed taller and narrower, and appeared to be spinning like the funnel of a cyclone. Not until then, still numbed and with his powers of reason almost in abeyance, did he remember his camera. He raised it to eye-level, and sighted towards that impossible, mind-shaking enigma.
Vindarten moved swiftly into his line of vision. With implacable firmness, the great hands covered the lens turret and forced him to lower the camera. Jan did not attempt to resist: it would have been useless, of course, but he felt a sudden deathly fear of that thing out there at the edge of the wOrld, and wanted no further part of it.
There was nothing else in all his travels that they would not let him photograph, and Vindarten gave no explanations.
Instead, he spent much time getting Jan to describe in minute detail what he had witnessed.
It was then that Jan realized that Vindarten's eyes had seen something totally different: and it was then that he guessed, fur the first time, that the Overlords had masters, too.

Now he was coming home, and all the wonder, the fear and the mystery were far behind. It was the same ship, he believed, though surely not the same crew. However long their lives, It was hard to believe that the Overlords would willingly cut themselves off from their home for all the decades consumed on an interstellar voyage.
The Relativity time-dilation effect worked both ways, of course. The Overlords would age only four months on the round trip, but when they returned their friends would be eighty years older.

Had he wished, Jan could doubtless have stayed here for the remainder of his life. But Vindarten had warned him that there would be no other ship going to Earth for several years, and had advised him to take this opportunity. Perhaps the Overlords realized that even in this relatively short time, his mind had nearly reached the end of its resources. Or he might merely have become a nuisance, and they could spare no more time for him.
It was of no importanct now, for Earth was there ahead.
He had seen it thus a hundred times before, but always through the remote, mechanical eye of the television camera.
Now at last he himself was out here in space, as the final act of his dream unfolded itself; and Earth spun beneath on its eternal orbit.
The great blue-green crescent was in its first quarter: more than half the visible disc was still in darkness. There was little cloud-a few bands scattered along the line of the trade winds.
The arctic cap glittered brilliantly, but was far outshone by the dazzling reflection of the sun in the north Pacific.
One might have thought it was a world of water: this hemisphere was almost devoid of land. The only continent visible was Australia, a darker mist in the atmospehric haze along the limb of the planet.
The ship was driving into Earth's great cone of shadow: the gleaming crescent dwindled, shrank to a burning bow of fire, and winked out of existence. Below was darkness and night.
The world was sleeping.
It was thea that Jan realized what was wrong. There was land down there-but where were the gleaming necklaces of light, where were the glittering coruscations that had been the cities of man? In all that shadowy hemisphere, there was no

single spark to drive back the night. Gone without a trace were the millions, of kilowatts that once had been splashed carelessly towards the stars. He might have been looking down on Earth as it had been before the coming of man.
This was not the homecoming he had expected. There was
nothing he could do but watch, while the fear of the unknown grew within him. Something had happened-something tinims~ginabIe. And yet the ship was descending purposefully in a
long curve that was taking it again over the sunlit hemisphere. He saw nothing of the actual landing, for the picture of
Earth suddenly winked out and was replaced by that meaning-
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less pattern of lines and lights. When vision was restored, they were on the ground. There were great buildings in the distance, machines moving about, and a group of Overlords watching them..
Somewhere there was the muffled roar of air as the ship equalized pressure, then the sound of great doors opening. He did not wait: the silent giants watched him with tolerance or indifference as he ran from the control room.
He was home, seeing once more by the sparkling light of his own familiar sun, breathing the air that had first washed through his lungs. The gangway was already down, but he had to wait for a moment until the glare outside no longer blinded him.
Karellen was standing, a little apart from his companions, beside a great transport vehicle loaded with crates. Jan did not stop to wonder how he recognized the Supervisor, nor was he surprised to see him completely unchanged. That was almost the only thing that had turned out as he had expected.
"I have been waiting for you," said Karellen..
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"1w the early days," said Karellen, "it was safe for us to go among them. But they no longer needed us: our work was done when we had gathered them together and given them a continent of their own. Watch."
The wall in front of Jan disappeared. Instead he was looking down from a height of a few hundred metres on to a pleasantly wooded country. The illusion was so perfect that he fought a momentary giddiness.
"This is five years later, when the second phase had begun." There were figures moving below, and the camera swooped down upon them like a bird of prey.
"This will distress you," said Karellen. "But remember that your standards no longer apply. You are not watching human children."
Yet that was the immediate impression that came to Jan's mind, and no amount of logic could dispel it. They might have been savages, engaged in some complex ritual dance. They were naked and filthy, with matted hair obscuring their
175
eyes. As faras Jan could tell, they were of all ages from five to fifteen, yet they all moved with the same speed, precision, and complete indifference to their surroundings.
Then Jan saw their faces. He swallowed hard, and forced
himself not to turn away. They were emptier than the faces of the dead, for even a corpse has some record carved by Time's
chisel upon its features, to speak when the lips themselves are dumb. There was no more emotion or feeling here than in the face of a snake or an insect. The Overlords themselves were more human than this.
"You are searching for something that is no longer there,"
said Karellen. "Remember-they have no more identity than the cells in your own body. But linked together, they are something much greater than you."
'Why do they keep moving like this ?"
"We called it the Long Dance," replied Karellen. "They never sleep, you know, and this lasted almost a year. Three hundred million of them, moving in a controlled pattern over a whole continent. We've analysed that pattern

endlessly, but it means nothing, perhaps because we can see only the physical part of it-the small portion that's here on Earth. Possibly what we have called the Overmind is still training them, moulding them into one unit before it can wholly absorb them into its being."
"But how did they manage about food? And what happened if they hit obstructions, like trees, or cliffs, or water?"
"Water made no difference: they could not drown. When they encountered obstacles, they sometimes damaged themselves, but they never noticed it. As for food-well, there was all the fruit and game they required. But now they have left that need behind, like so many others. For food is largely a source of energy, and they have learned to tap greater sources."
The scene flickered as if a heat haze had passed over it. When it cleared, the movement below had ceased.
"Watch again," said Karellen. "It is three years later."
The little figures, so helpless and pathetic if one did no, know the truth, stood motionless in forest and glade and plaint The camera roamed restlessly from one to the other: already.
thought Jan, their faces were merging into a common mould. He had once seen some photographs made by the superposition of dozens of prints to give one "average" face. The result had been as empty, as void of character as this.

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They seemed to be sleeping or entranced. Then eyes were
tightly closed, and they showed no more awareness of their
surroundings than did the trees under which they stood. What thoughts, Jan wolidered, were echoing through the intricate network in which their minds were now no more-and yet no less-than the separate threads of some great tapestry? And a tapestry, he now realized, that covered many worlds and many races-and was growing still.
It happened with a swiftness that dazzled the eye and stunned the brain. At one moment Jan was looking down upon a beautiful, fertile country with nothing strange about it save the countless small statues scattered-yet not randomly-over its length and breadth. And then in an instant all the trees and grass, all the living creatures that had inhabited this land, flickered out of existence and were gone. There were left only the still lakes, the winding rivers, the rolling brown hills, now stripped of their green carpet-and the silent, indifferent figures who had wrought all this destruction.
"Why did they do it?" gasped Jan.
"Perhaps the presence of other minds disturbed them- even the rudimentary minds of plants and animals. One day, we believe, they may find the material world equally distracting. And then, who knows what will happen? Now you understand why we withdrew when we had done our duty. We are still trying to study them, but we never enter their land or even send our instruments there. All we dare do is to observe from space."
"That was many years ago," said Jan. "What has happened since?"
"Very little. They have never moved in all that time, and take no notice of day or night, summer or winter. They are still testing their powers; some rivers have changed their courses, and there is one that flows uphill. But they have done nothing that seems to have any purpose."
"And they have ignored you completely?"
"Yes, though that is not surprising. The-entity-of which they are part knows all about us. It does not seem to care if we attempt to study it. When it wishes us to leave, or has a new task fbr us elsewhere, it will make its desires very obvious. Until then, we will remain here so that our scientists can gather what knowledge they may."
So this, thought Jan, with a resignation that lay beyond all

sadness, was the end of man. It was an end that no prophet had ever foreseen-an end that repudiated optimism and pessimism alike.
Yet it was fitting: it had the sublime inevitability of a great work of art. Jan had glimpsed the universe in all its awful immensity, and knew now that it was no place for man. He realized at last how vain, in the ultimate analysis, had been the dream that had lured him to the stars.
For the road to the stars was a road that forked in two directions, and neither led to a goal that took any account of human hopes or fears.
At the end of one path were the Overlords. They had preserved their individually, their independent egos; they possessed self-awareness and the pronoun "I" had a meaning in their language. They had emotions, some at least of which were shared by humanity. But they were trapped, Jan realized now, in a cul-de-sac from which they could never escape. Their minds were ten-perhaps a hundred-times as powerful as men's. It made no difference in the final reckoning. They were equally helpless, equally overwhelmed by the unimaginable complexity of a galaxy of a hundred thousand million suns, and a cosmos of a hundred thousand million galaxies.
And at the end of the other path? There lay the Overmind, whatever it might be, bearing the same relation to man as man bore to amcr.ba. Potentially infinite, beyond mortality, how long had it been absorbing race after race as it spread across the stars? Did it too have desires, did it have goals it sensed dimly yet might never attain? Now it had drawn into its being all that the human race had ever achieved. This was not tragedy, but fulfilment. The billions of transient sparks of consciousness that had made up humanity would flicker no more like flreffies against the night. But they had not lived utterly in vain.
The last act, Jan knew, had still to come. It might occur tomorrow, or it might be centuries hence. Even the Overlords could not be certain.
He understood their purpose now, what they had done with Man and why they still lingered upon Earth. Towards them he felt a grcat humility, as well as admiration for the inflexible patience that had kept them waiting here so long.
He never learned the full story of the strange symbiosis between the Overmind and its servants. According to Rasha

verak, there had never been a time in lus rac&s history when the Overmind was not there, though it had made no use of them until they had achieved a scientific civilization and could range through space to do its bidding.
"But why does it need you?" queried Jan. "With all its tremendous powers, surely it could do anything it pleased."
"No," said Rashaverak, "it has limits. In the past, we know, it has attempted to act directly upon the minds of other races, and to influence their cultural development. It's always failed, perhaps because the pull is too great. We are the interpreters-the guardians. Or, to use one of your own metaphors, we till the field until the crop is ripe. The Overmind collects the harvest-and we move on to another task. This is the fifth race whose apotheosis we have watched. Each time we learn a little more."
"And do you not resent being used as a tool by the Over-mind?"
"The arrangement has some advantages: besides, no-one of intelligence resents the inevitable."
That proposition, Jan reflected wryly, had never been fully accepted by mankind. There were things beyond logic that the Overlords had never understood.
"It seems strange," said Jan, "that the Overmind chose you to do its work, if you have no trace of the paraphysical powers latent in mankind. How does it communicate with you and make its wishes known?"
"That is one question I cannot answer-and I cannot tell you the reason why I must keep the facts from you. One day, perhaps, you will know some of the truth."

Jan puzzled over this for a moment, but knew it was useless to follow this line of inquiry. He would have to change the subject and hope to pick up clues later.
"Tell me this, then," he said, "this is something else you've never explained. When your race first came to Earth, back in the distant past, what went wrong? Why had you become the symbol of fear and evil to us?"
Rashaverak smiled. He did not do this as well as Karellen could, but it was a fair imitation.
"No-one ever guessed, and you see now why we could never ;ell you. There was only one event that could have made such an impact upon humanity. And that event was not at the dawn of history, but at its very end."

"What do you mean?" asked Jan.
'When our ships entered your skies a centmy and a half ago, that was the first meeting of our two races, though of course we had studied you from a distance. And yet you feared
and recognized us, as we knew that you would. It was not
precisely a memory. You have already had proof that time is
more complex than your science ever imagined. For that memory was not of the past, but of thefuture-of those dosing years when your race knew that everything was finished. We did what we could, but it was not an easy end. And because we were there, we became identified with your race's death.
Yes, even while it was still ten thousand years in the future!
It was as if a distorted echo had reverberated round the closed cirde of time, from the future to the past. Call it not a memory, but a premonition."
The idea was hard to grasp, and for a moment Jan wrestled with it in silence. Y~t he should have been prepared; he had already received proof enough that cause and event could reverse their normal sequence.
There must be such a thing as racial memory, and that memmy was somehow independent of time. To it, the future and the past were one. l'hat was why, thousands of years ago, men
hadalreadyglimpsedadistortedimageoftheOverlords,through a mist of fear and terror.
"Now I understand," said the last man,.

The Last Man! Jan found it very hard to think of himself as that. When he had gone into space, he had accepted the possibility of eternal exile from the human race, and loneliness had not yet come upon him. As the years passed, the longing to see another human being might rise and overwhelm him, but for the present, the company of the Overlords prevented him from feeling utterly alone.
There had been men on Earth as little as ten years ago, but they had been degenerate survivors and Jan had lost nothing by missing them. For reasons which the Overlords could not explain, but which Jan suspected were largely psychological, there had been no children to replace those who had gone. Homo sapiens was extinct.
Perhaps, lost in one of the still-intact cities, was the manuscript of some later-day Gibbon, recording the last days of

the human race. If so, Jan was not sure that he would care to read it; Rashaverak had told him all that he wished to know.
Those who had not destroyed themselves had sought oblivion in ever more feverish activities, in fierce and suicidal sports that were often indistinguishable from minor wars. As the population had swiftly fallen, the ageing survivors had clustered together, a defeated army closing its ranks as it made its last retreat.

That final act, before the curtain came down for ever, must have been lit by flashes of heroism and devotion, darkened by savagery and selfishness. Whether it had ended in despair or resignation, Jan would never know.

There was plenty to occupy his mind. The Overlords' base was about a kilometre from a deserted villa, and Jan spent months fitting this out with equipment he had taken from the nearest town, some thirty kilometres distant. He had flown there with Rashaverak, whose friendship, he suspected, was not completely altruistic. The Overlord psychologist was still studying the last specimen of Homo sapiens.

The town must have been evacuated before the end, for the houses and even many of the public services were still in good order. It would have taken little work to restart the generators, so that the wide streets glowed once more with the illusion of life. Jan toyed with the idea, then abandoned it as too morbid. The one thing he did not wish to do was to brood upon the past.

There was everything here that he needed to maintain himself for the rest of his life, but what he wanted most was an electronic piano and certain Bach transcriptions. He had never had as much time for music as he would have liked, and now he would make up for it. When he was not performing himself~, he played tapes of the great symphonies and concertos, so that the villa was never silent. Music had become his talisman against the loneliness which, one day, must surely overwhelm him.

Often he would go for long walks on the hills, thinking of all that had happened in the few months since he had last seen Earth. He had never thought, when he said goodbye to Suffivan eighty terrestrial years ago, that the last generation of mankind was already in the womb.

What a young fool he had been! Yet he was not sure that he regretted his action; had he stayed on Earth, he would have

witnessed those dosing years over which time had now drawn a veil. Instead, he had leap-frogged past them into the future, and had learned the answers to questions that no other man would ever know. His curiosity was almost satisfied, but sometimes he wondered why the Overlords were waiting, and what would happen when their patience was at last rewarded.

But most of the time, with a contented resignation that comes normally to a man only at the end of a long and busy life, he sat before the keyboard and filled the air with his beloved Bach. Perhaps he was deceiving himself, perhaps this was some merciful trick of the mind, but now it seemed to Jan that this was what he had always wished to do. His secret ambition had at last dared to emerge into the full light of consciousness.

Jan had always been a good pianist-and now he was the finest in the world.

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IT was Rashaverak who brought him the news, but he had already guessed it. In the small hours of the morning a nightmare had awakened him, and he had not been able to regain sleep. He could not remember the dream, which was very strange, for he believed that all dreams could be recalled if one tried hard enough immediately after waking. All he could remember of this was that he had been a small boy again, on a vast and empty piain, listening to a great voice calling in an unknown language.

The dream had disturbed him: he wondered if it was the first onslaught of loneliness upon his mind. Restlessly, he walked out of the villa on to the neglected lawn.

A full moon bathed the scene with a golden light so brilliant that he could see perfectly. The immense gleaming cylinder of Karellen's ship lay beyond the buildings of the Overlord base, towering above them and reducing them to man-

made proportions. Jan looked at the ship, trying to recall the emotions it had once roused in him. There was a time when it had been an unattainable goal, a symbol of all that he had never really expected to achieve. And now it meant nothing.

How quiet and still it wail The Overlords, of course1 would

be as active as ever, but for the moment there was no sign of them. He might have been alone on Earth-as, indeed, in a very real sense he was. He glanced up at the Moon, seeking some familiar sight on which his thoughts could rest. There were the ancient, well-remembered seas. He had been forty light-years into space, yet he had never walked on those silent, dusty plains less than two light-seconds away. For a moment he amused himself trying to locate the crater Tycho. When he did discover it, he was puzzled to find that gleaming speck further from the centre line of the disc than he had thought. And it was then that he realized that the dark oval of the Mare Crisium was missing altogether. The face that her satellite now turned towards the Earth was not the one that had looked down on the world since the dawn of life. The Moon had begun to turn upon its axis.

That could mean only one thing. On the other side of the Earth, in the land that they had stripped so suddenly of life, they were emerging from their long trance. As a waking child may stretch its arms to greet the day, they too were flexing their muscles and playing with their new-found powers.

"You have guessed correctly," said Rashaverak. "It is no longer safe for us to stay. They may ignore us still, but we cannot take the risk. We leave as soon as our equipment can be loaded-probably in two or three hours."

He looked up at the sky, as if afraid that some new miracle was about to blaze forth. But all was peaceful: the Moon had set, and only a few clouds rode high upon the west wind.

"It does not matter greatly if they tamper with the Moon," Rashaverak added, "but suppose they begin to interfere with the Sun? We shall leave instruments behind, of course, so that we can learn what happens."

"I shall stay," said Jan abruptly. "I have seen enough of the universe. There's only one thing I'm curious about now- and that is the fate of my own planet."

Very gently, the ground trembled underfoot.

"I was expecting that," Jan continued. "If they alter the MooLi's spin, the angular momentum must go somewhere. So the Earth is slowing down. I don't know which puzzles me more-how they are doing it, or why."

"They are still playing," said Rashaverak. "What logic is

there in the actions of a child? And in many ways the entity thatyourracehasbecomeisstillachild. Itisnotyetreadyto unite with the Overmind. But very soon it will be, and then

you will have the Earth to your own."

He did not complete the sentence, and Jan finished it for him.

"If, of course, the Earth still exists."

"You realize that danger-and yet you will stay?"

"Yes. I have been home five-or is it six?-years now. Whatever happens, I'll have no complaints."

"We were hoping," began Rashaverak slowly, "that you

would wish to stay. There is something that you can do for

us. .. ."

The glare"of the Stardrive dwindled and died, somewhere out there beyond the orbit of Mars. Along that road, thought Jan, he alone had travelled, out of all the billions of human beings who had lived and died on Earth. And no-one would ever travel it again.

The world was his. Everything he needed-all the material possessions anyone could ever desire-were his for the taking. But he was no longer interested. He feared neither the loneliness of the deserted planet, nor the presence that still rested here in the last moments before it went to seek its unknown heritage. In the inconceivable backwash of that departure, Jan did not expect that he and his problems would long survive.

That was well. He had done all that he.had wished to do, and to drag out a pointless life on this empty world would hive been unbearable anticlimax. He could have left with the Overlords, but for what purpose? For he knew, as no-one else had ever known, that Karellen spoke the truth when he had said:

"The stars are not for Man."

He turned his back upon the night and walked through the vast entrance of the Overlord base. Its size affected him not in the least: sheer immensity no longer had any power over his mind. The lights were burning redly, driven by energies that could feed them for ages yet. On either side lay machines whose secrets he would never know, abandoned by the Overlords in their retreat. He went past them, and clambered awkwardly up the great steps until he had reached the control room.

The spirit of the Overlords still lingered here: their machines were still alive, doing the bidding of their now fir-distant
masters. What could he add, wondered Jan, to the information they were already hurling into space?

He climbed into the great chair and made himself as comfortable as he could. The microphone, already alive, was waiting for him: something that was the equivalent of a TV camera must be watching, but he could not locate it.

Beyond the desk and its meaningless instrument panels, the wide windows looked out into the starry night, across a valley sleeping beneath a gibbous moon, and to the distant range of mountains. A river wound along the valley, glittering here and there as the moonlight struck upon some patch of troubled water. It was all so peaceful. It might have been thus at Man's birth as it was now at his ending.

Out there across unknown millions of kilometres of space, Karellen would be waiting. It was strange to think that the ship of the Overlords was racing away from Earth almost as swiftly as his signal could speed after it. Almost-but not quite. It would be a long chase, but his words would catch the Supervisor and he would have repaid the debt he owed.

How much of this, Jan wondered, had Karellen planned, and how much was masterful improvisation? Had the Supervisor deliberately let him escape into space, almost a century ago, so that he could return to play the role he was flulfihling now? No, that seemed too fantastic. But Jan was certain now, that Karellen was involved in some vast and complicated plot. Even while he served it, he was studying the Overmind with all the instruments at his command. Jan suspected that it was not only scientific curiosity that inspired the Supervisor: perhaps the Overlords had dreams of one day escaping from their peculiar bondage, when they had learned enough about the powers they served.

That Jan could add to that knowledge by what he was now doing seemed hard to believe. "Tell us what you see," Rashaverak had said. "The picture that reaches your eyes will be duplicated by our cameras. But the message that enters your brain may be very different, and it could tell us a great deal."

Well, he would do his best.

"Still nothing to report," he began. "A few minute, ago I saw the trail of your ship disappear in the sky. 'ihe Moon is

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just past full, and almost half its familiar side has now turned away from Earth-but I suppose you already know that."
Jan paused, feeling slightly foolish. There was something incongruous, even faintly absurd, about what he was doing.
Here was the climax of all history, yet he might have been a radio-commentator at a race-track or a boxing-ring. Then he shrugged his shoulders and put the thought aside. At all moments of greatness, he suspected, bathos had never been very far away-and certain he alone could sense its presence here.
"There have been three slight 'quakes in the last hour," he continued. "Their control of Earth's spin must be marvellous, but not quite perfect.... You know, Karellen, I'm going to find it very hard to say anything your instruments haven't already told you. It might have helped if you'd given me some idea of what to expect, and warned me how long I may have to wait. If nothing happens, I'll report again in six hours, as we arranged-.
"Hello! They must have been waiting for you to leave. Something's starting to happen. The stars are becoming dimmer. It's as if a great doud is coming up, very swiftly, over all the sky. But it isn't really a doud. It seems to have some sort of structure-I can glimpse a hazy network of lines and bands that keep changing their positions. It's almost as if the stars are tangled in a ghostly spider's web.
"The whole network is beginning to glow-to pulse with light, exactly as if it were alive. And I suppose it is: or is it something as much beyond life as that is above the inorganic world?
"The glow seems to be shifting to one part of the sky-wait a minute while I move round to the other window.
"Yes-I might have guessed. There's a great burning column, like a tree of fire, reaching above the western horizon. It's a long way off, right round the world. I know where it springs from: they're on their way at last, to become part of the Overmind. Their probation is ended: they're leaving the last remnants of matter behind.
"As that fire spreads upwards from the Earth, I can see the network becoming firmer and less misty. In places, it seems almost solid-yet the stars are still shining faintly through it.
"I've just realized. It's not exactly the same, but the thing I saw shooting up above your world, Karellen, was very much
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like this. Was that part of the Overmind? I suppose you hid the truth from me so that I would have no preconceived ideas -so that I'd be an unbiased observer. I wish I knew what your cameras were showing you now, to compare it with what my mind imagines I'm seeing!
"Is this how it talks to you, Karellen, in colours and shapes like these? I've remembered the control screens on your ship and the patterns that went across them, speaking to you in some visual language which your eyes could read.
"Now it looks exactly like the curtains of the aurora, dancing and flickering across the stars. Why, that's what it really is, I'm sure-a great auroral storm. The whole landscape is lit up-it's brighter than day-reds and golds and greens are chasing each other across the sky-oh, it's beyond words, it doesn't seem fair that I'm the only one to see it-I never thought such colours- "The storm's dying down, but the great misty network is still there. I think that aurora was only a by-product of whatever energies are being released up there on the frontier of space.
"Just a minute: I've noticed something else. My weight':

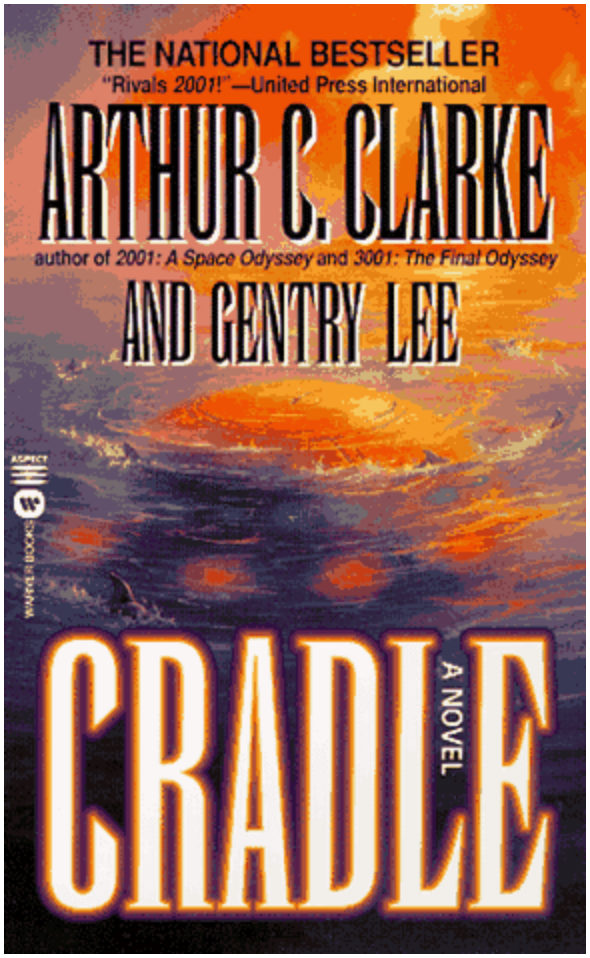
decreasing. What does that mean? I've dropped a pencil-it's falling slowly. Something's happened to gravity-there's a great wind coming up-I can see the trees tossing their branches down there in the valley.
"Of course-the atmosphere's escaping. Sticks and stones are rising into the sky, almost as if the Earth itself is trying to follow Them out into space. There's a great cloud of dust, whipped up by the gale. It's becoming hard to see. . . perhaps It will dear in a moment.
"Yes-that's better. Everything movable has been stripped away-the dust clouds have vanished. I wonder how long this building will stand? And it's getting hard to breathe-I must try and talk more slowly.
"I can see clearly again. That great burning column is still there, but it's constricting, narrowing-it looks like the funnel of a tornado, about to retract into the clouds. And-oh, this is hard to describe, but just then I felt a great wave of emotion sweep over me. It wasn't joy or sorrow; it was a sense of fulfilment, achievement. Did I imagine it? Or did it come from outside? I don't know.
"And now-this can't be all imagination-the world feels

empty. Utterly empty. It's like listening to a radio set that's suddenly gone dead. And the sky is dear again-the misty
web has gone. What world will it go to next, Karellen? And will you be there to serve it still?
"Strange: everything around me is unaltered. I don't know why, but somehow I'd thought that-"
Jan stopped. For a moment he struggled for words, then
closed his eyes in an effort to regain control. There was no room for fear or panic now: he had a duty to perform-a duty to Man, and a duty to Karellen. Slowly at first, like a man awaking from a dream, he began to speak.
"The buildings round me-the ground-the mountains-everything's like glass-I can see through it. Earth's dissolving
-my weight has almost gone. You were right-they've
finished playing with their toys.
"It's only a few seconds away. There go the mountains, like wisps of smoke. Goodbye, Karellen, Rashaverak-I am sorry f~ you. Though I cannot understand it, I've seen what my race became. Everything we ever achieved has gone up there into the stars. Perhaps that's what the old religions were trying to say. But they got it all wrong: they thought mankind was so important, yet we're only one race in-doyou know how many? Yet now we've become something that you could never be.
"There goes the river. No change in the sky, though. I can hardly breathe. Strange to see the Moon still shining up there. I'm glad they left it, but it will be lonely now- "The light! From beneath me-inside the Earth-shining upward, through the rocks, the ground, everything-growing brighter, brighter, blinding-"

In a soundless concussion of light, Earth's core gave up its hoarded energies. For a little while the gravitational waves crossed and re-crossed the Solar System, distubing ever so slightly the orbits of the planets. Then the Suit's remaining children pursued their ancient paths once more, as corks floattng~on a placid lake ride out the tiny ripples set in motion by a falling stone.
There was nothing left of Earth. They had teethed away the last atoms of its substance. It had nourished them, through the fierce moments of their inconceivable meta

norphosis, as the food stored in a grain of wheat feeds the
nfant plant while it climbs towards the Sun.

Six thousand million kilometres beyond the orbit of Pluto,
Karellen sat before a suddenly darkened screen. The record was complete, the mission ended; he was homeward bound !br the world he had left so long ago. The weight of centuries was upon him, and a sadness that no logic could dispel. He lid not mourn for Man: his sorrow was for his own race, forever barred from greatness by forces it could not overcome.
For all their achievements, thought Karellen, for all their mastery of the physical universe, his people were no better than a tribe that had passed its whole existence upon some flat and dusty plain. Far off were the mountains, where power and beauty dwelt, where the thunder sported above the glaciers and the air was clear and keen. There the sun still walked, transfiguring the peaks with glory, when all the land below was wrapped in darkness. And they could only watch and wonder: they could never scale those heights.
Yet, Karellen knew, they would hold fast until the end: they would await without despair whatever destiny was theirs. They would serve the Overmind because they had no choice, but even in that service they would not lose their souls.
The great control screen flared for a moment with sombre, ruby light: without conscious effort, Karellen read the message of its changing patterns. The ship was leaving the frontiers of the Solar System: the energies that powered the Stardrive were ebbing fast, but they had done their work.
Karellen raised his hand, and the picture changed once more. A single brilliant star glowed in the centre of the screen: no-one could have told, from this distance, that the Sun had ever possessed planets or that one of them had now been lost. For a long time Karellen stared back across that swiftly widening gulf~, while many memories raced through his vast and labyrinthiric mind. In silent farewell, he saluted the men he had known, whether they had hindered or helped him ta his purpose.
No-one dared disturb him or interrupt his thoughts: and presently he turned his back upon the dwindling Sun.



Cradle
by: Arthur C. Clarke
& Gentry Lee
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THE emerald water smashes against the dark volcanic cliffs. Fine white spray hovers over the harsh rock creating a misty veil that glimmers in the fading light. In the distance, two yellow suns set simultaneously, separated by about forty degrees as they disappear together below the horizon. Across the blue-black sky, on the opposite side of the isthmus that slopes gently downward from the volcanic cliffs to another ocean, a pair of full moons rise as the two suns vanish. Their twin moonlight, although much weaker than the shine of the disappearing suns, is still strong enough to create dancing moon shadows on the ocean beneath the rocky overhang.

As the dual moons rise on the eastern side of the isthmus, light begins to glow on the horizon beside them, about twenty degrees to the south. At first the glow looks like the light of a distant city, but with each passing moment it brightens until it spreads across the sky. At length an awesome third moon, its first chord coming over the horizon when the twin moons are maybe ten degrees into their arc, begins to rise. Calm descends on both oceans for a few seconds, as if the world beneath the giant orb has paused to give homage to the spectacular sight. This great yellow moon, its face clearly scarred by craters, appears to be surveying its dominion as it slowly rises in the sky and bathes

the emerald oceans in a mysterious reflected light. It is a hundred times the size of the smaller twin moons and its wide swath through the sky is greater in size than that cut minutes before by the pair of setting suns

Below the cliffs, in the shadow of the newest moon, a long sinuous object arcs its way out of the water, rising nearly twenty feet above the surface. The slender apparition twists itself toward the cliffs and thrusts itself forward as the piercing sound of a trumpet, a solo blast, reverberates against the rocks and carries across the isthmus. A moment later another sound is heard, a muted echo or possibly a reply from the other sea. The creature swims gracefully into the moonlight, its long, lithe neck a cobalt blue above a gray body mostly submerged in the ocean. Now the bluenecked serpent extends itself upward again and leans toward the land, its face revealed in the expanding moonlight. The facial features are convoluted and complex, with rows of orifices of unknown purpose. At the peak of its extension, the creature contorts its face and a medley of sounds is heard; the trumpet blast is now accompanied by an oboe and an organ. After a short pause a muted response, quieter but with the same rich complexity of sound, comes back across the isthmus.

The serpent swims north along the shore. Behind it in the moonlight half a dozen other swirling necks rise from the ocean. These creatures are a little smaller, the hues of their cobalt necks not quite so vivid. This ensemble turns as one, on cue, and blasts six trumpet calls to the east. Again a pause precedes the expected response, the sound of several smaller trumpets from across the land. Immediately the six new creatures and their distant friends begin a complex, interleaved musical pattern, slowly building in intensity until the overture reaches an inevitable crescendo and then abruptly abates.

After a few moments more the oceans on both sides of the isthmus become alive with teeming serpents of all sizes. Hundreds, even thousands, of serpents, covering the water for as far as the eye can see, begin languorously extending their necks, twisting as if looking around, and joining in the singing. The serpents of the eastern sea are slightly smaller than their western cousins. The necks of the eastern serpents are pale blue instead of cobalt. These pale blue serpents are also joined by a nursery of tiny creatures, the palest of blue markings on their necks, whose singing is high-pitched and a trifle erratic and sounds like piccolos interspersed with crystal bells.

The waters of the emerald oceans begin to surge forward in tidal frenzy, now rapidly moving up the rocky cliffs on the western side and quickly submerging great chunks of land on the sloping side that runs to the eastern ocean. The concerted pull of all the moons produces a tide that will eventually cover the isthmus completely, uniting the two oceans. As the waters draw ever closer together, the music from the thousand singing serpents swells to magnificence, flooding the entire area with a sound of mesmerizing beauty. It is also a plaintive sound of longing and anticipation, the universal cry of long-suppressed desire on the verge of being satisfied.

The great longnecked serpents of Canthor conclude their annual mating symphony as the two oceans become one and the inhabitants of each ocean seek out their lifelong mates in the united waters. There are five nights out of each Canthorean year when the tidal forces act together to submerge the isthmus and permit the sexual mixing of the serpents. Five nights of love play and frolicking, of renewal and promise, before the requisite return to the separate oceans and a year of waiting for the great tide to come again.

For the little ones, the new serpents placed into gestation by the last annual gathering and hatched by their mothers in the eastern ocean, the great tide is a time of excitement and sadness. They must now separate from their playmates, leave their infancy behind. Half must depart from their mothers as well and go to swim among the cobalt blue adults that they have never met. This half, having lived their lives among their mothers' friends exclusively, will

swim above and across the isthmus on the fifth night alongside their fathers. Once into the western ocean, their pale blue necks will begin to deepen in color as they begin the transition through puberty into adulthood. And next year, their tiny voices will have matured just enough that each of them may detect some arousing and positive response to his call during the mating symphony

Thousands of years pass on the planet Canthor. The forces of change conspire against the beautiful bluenecked serpents. First a major ice age comes to the world, locking up more of the planet's water in perennial polar caps and lowering the seas. The number of days that the great tide submerges the isthmus is reduced to four, then three, and finally only two. The elaborate mating ritual of the serpents, worked out over hundreds of generations, works best for a five-night courtship. For the several hundred years that only two nights are available for mating, the number of serpent offspring produced each year drops precipitously. The total number of Canthorean serpents becomes dangerously small.

At length the radiative output of the dual suns increases slightly again and Canthor emerges from its ice age. The sea level rises and the number of days for mating returns eventually to five. The serpent symphony, which had added a saddened counterpoint during the trying years of reduced mating nights, again becomes charged with joy. For several generations the number of serpents increases. But then the lovely creatures encounter another foe.

Evolving elsewhere on Canthor for almost a million years has been another intelligent species, a fierce, squat creature with an insatiable appetite for control. The ice age stimulated the rapid evolution of these trolls by enforcing a strict survival of the fittest that naturally selected those individuals with the most resources (intelligence and power primarily) and, in a sense, purified the troll gene pool.

The troll species that emerges from the thousands of years of ice domination on Canthor is sharper and more capable of dealing with the rest of its environment. It has become a tool maker and has learned how to use the riches of the planet for its benefit. No other living creatures on Canthor can match the cleverness of the trolls or threaten their existence. So the trolls proliferate around the planet, dominating it completely with their rapaciousness.

The bluenecked serpents have had no natural enemies on Canthor for hundreds of millennia. Therefore they have not retained the aggression and territoriality necessary to survive when threatened. Their diet has always consisted primarily of plants and animals that fill the Canthorean oceans. The seas provide a virtual cornucopia of food, so it does not make much of an impression upon the serpents when the trolls begin to farm the oceans for their own food. To the trolls, however, whose greed for territory knows no bounds, the serpents represent at least a rival for the plenty of the oceans and possibly, because of their size and intelligence, even a survival threat.

It is again the time of the great tide and the male longnecked serpents have completed their ocean migration on time, swarming as usual just opposite the great volcanic cliffs. There are only a few hundred male serpents now, down markedly from the halcyon years when they were so numerous they stretched as far as the eye could see. The giant full moon rises as it has for thousands of years, following the twin smaller moons into the sky, and the overture announces the coming mating symphony. But as the tide rolls in to submerge the isthmus, the serpents sense that something is wrong. A growing cacophony creeps into the mystical mating song. Anxiety spreads by sound across both sides of the land separating the serpents. When the tide finally surges over the top of the volcanic rocks, the point in the original mating symphony for the magnificent

final crescendo, the sound of the serpents' pleading wail fills the Canthorean night.

The trolls have erected a huge barrier down the spine of the isthmus. Carefully calculated to be just tall enough to preclude passage to the largest of the serpents, this oppressive barrier allows the lovely bluenecked creatures, if they strain, to sense one another at close range but not to touch. The nights of the great tide are extremely painful to watch. From both sides the serpents hurl themselves repeatedly and ineffectually at the wall, trying desperately to make contact with their mates. But it is all in vain. The barrier holds. The serpents are unable to mate. Both sexes return eventually to their respective oceans, deeply saddened and profoundly aware of the implications of the barrier for their future.

Some of the serpents batter themselves nearly senseless as they try to break down the wall. These wounded ones on both sides of the isthmus remain behind to recover while the rest of the species, resuming the annual migration as if the normal mating had indeed taken place, slowly and sadly swim away, each sex heading for a separate reach of Canthor.

It is two nights after the great tide has stopped submerging the land between the oceans. Two older male serpents, their necks still bruised from the repeated bootless hammerings against the hated barrier, are swimming slowly together in the moonlight. A strange light in the sky comes swiftly upon them from above. It hovers over the serpents, seeming to spotlight them as they crane their necks to see what is happening.

In a moment the graceful necks keel forward and slap down upon the moonlit ocean. From out of the light above them comes an object, a basket of some kind, that descends to the water. The two serpents are scooped up, lifted silently out of the sea into the air, reeled in by some unknown fisherman in the sky above them. The same scene repeats a dozen times, first in the western ocean with the wounded serpents whose necks are cobalt blue, then in the eastern ocean with their pale blue counterparts. It is as if a great roundup is taking place, removing all the exhausted serpents who had been unable to take their place with the rest of the species in the annual migration.

Far above Canthor a gigantic cylindrical spaceship awaits the return of its robot minions. Twenty miles on a side, this traveling planet opens itself to a fleet of returning vehicles the size of large airplanes that bring back the quarry from Canthor. The cylinder rotates slowly as Canthor and its giant moon shine in the background. A solo laggard vehicle returns a door opens to receive it in the back of the larger craft, and for a while there is no more activity. At length the cylinder tips over on its side and fires several small rockets. It is out of sight in seconds, departing Canthor for other worlds.

The snow falls steadily on the huge man trudging silently through the forest. Clad in skins, carrying a heavy load on his back and a large spear in one hand, he turns his hairy, unkempt face toward the others behind him, his family, and grunts at them to hurry. There are five altogether, an infant carried by the woman and two teenage children. The teenagers are wearing skins like their parents and have large bundles slung across their backs. The teenage boy is also carrying a spear. At close distance all of them look very weary, almost exhausted.

They break free from the forest for a moment and enter a meadow that surrounds a frozen pond. The snow continues to fall, adding to the three inches that already cover the ground. The father motions to his family to stop and approaches the pond gingerly. As the others huddle together against the cold, the man takes a crude tool from his bundle and, after brushing the snow off the surface of the pond in a small area, begins to cut the ice. Almost an hour passes. Finally he succeeds, utters a grunt of happiness, and bends down to

drink the water. He pulls out a skin, fills it, and brings the water to his wife and children.

The teenage daughter smiles at her father, a smile of love and admiration, as he offers her the water. Her face is tired, etched with the lines of sun and wind and cold. She reaches up to take the skin. Suddenly her face contorts with fear, she screams, and her father turns just in time to protect himself from a snarling wolf, midair in an attack. He strikes the wolf full force with his powerful arm, knocking it away from its target, and then stumbles toward his spear on the ground beside the pond. He grabs the spear and turns around quickly, prepared to defend his family.

Three wolves have attacked them. His son has deftly impaled one of the wolves through the midriff with his spear, but now a second wolf has pinioned the boy, defenseless in the snow, before he has been able to withdraw his weapon and strike again. In a frenzy, the father jumps forward and thrusts his spear into the wolf attacking his son. But it is too late. The hungry wolf had already found the boy's throat, severing the jugular vein with one quick snap of his powerful jaws.

Whirling around, the caveman moves against the last of the wolves. His wife lies bleeding in the snow and his infant child is unprotected, screaming in its wrappings some twenty feet from the mother. The last wolf, wary of the huge man, feints an attack against the father and then leaps for the baby. Before the man can respond, the wolf has grabbed the baby by its clothes and headed off for the forest.

The young girl was spared physical injury in the attack but was devastated by the near instant death of her brother and the disappearance of her tiny sister. She holds her dead brother's hand and sobs uncontrollably. The father stuffs virgin snow in the wife's wounds and then lifts her upon his back along with the heavy bundles. He grunts a couple of times to his daughter and she finally, reluctantly, picks herself up and starts gathering what remains of the family's things into another bundle.

As night falls the three surviving members of the family are approaching some caves at the edge of the forest. The father is near exhaustion from the weight of his wife and the family's meager belongings. He sits down to rest for a moment. His daughter stumbles down beside him, placing her head in his lap. She cries silently and her father tenderly wipes away her tears. A bright light suddenly shines down on them from above and an instant later all three are unconscious.

A tethered metallic basket about fifteen feet long and five feet wide descends in the eerie snowy light and comes to rest softly on the ground beside the three humans. The sides of the basket drop and metal belts extend themselves outward, wrapping around each of the people. They are pulled into the basket, the sides of the basket are closed, and the strange object then ascends into the snowy night. Seconds later the spotlight disappears and life returns to normal in the prehistoric forest.

Above the Earth the giant cylinder sits quietly, waiting for its messengers to return. The planet below is nearly cloudless and the great blue stretches of ocean tremble like jewels in the reflected sunlight. Near the evening terminator, the low sun angles show a vast expanse of ice extending down from the North Pole, covering almost all of a large continent. To the west, across a great ocean and an all white northern island, the midday sun shines on another large continent. It is also mostly covered by ice. Here the ice extends southward across two thirds of the land mass and only disappears completely as the continent begins to taper and the southern sea is reached.

The hunting shuttles sent out from the great cylinder return to their base and unload their prey. The father, injured mother, and teenage daughter are inside the small shuttle craft along with fifty to sixty other humans, obviously selected from disparate points around the world. None of the humans is moving.

After the shuttle safely docks with the mother ship, all the prehistoric humans are moved in a large van to a receiving station. Here they are admitted and catalogued, and then taken inside a vast module that re-creates the environment of Earth.

Far above the Earth, the last of the drone scouts returns to the giant cylinder. There is a momentary pause, as if some unknown checklist were being verified, and then the cylindrical space vehicle disappears.

THURSDAY
1

THEY were there on the beach at sunrise. Sometime during the night seven whales had run aground at Deer Key, five miles east of Key West. The powerful leviathans of the deep, ten to fifteen feet long, looked helpless as they lay floundering on the sand. Another half dozen members of this misguided pod of false killer whales were swimming in circles in the shallow lagoon just off the beach, obviously lost and confused.

By seven o'clock on the clear March morning, whale experts from Key West had arrived and were already beginning to coordinate what would later become a concerted effort by local fishermen and boating enthusiasts to push the beached animals back into the lagoon. Once the whales were off the beach, the next task would be to coax the entire pod into the Gulf of Mexico. There was little or no chance that the animals would survive unless they could be returned to open water.

Carol Dawson was the first reporter to arrive. She parked her sporty new Korean station wagon on the shoulder of the road, just off the beach, and jumped out to analyze the situation. The beach and lagoon at Deer Key formed a cove that was shaped like a half moon. An imaginary cord connecting the two points of land at the ends of the cove would extend almost half a mile across the water. Outside the cord was the Gulf of Mexico. The seven whales had penetrated the cove in the center and were beached at the point farthest from the open sea. They were about thirty feet apart and maybe twenty-five feet up on the sand. The rest of the whales were trapped in the shallows no more than a hundred feet offshore.

Carol walked around to the back of her station wagon. Before pulling out a large photographic case, she stopped to adjust the strings on her pants. (She had dressed quickly this morning when awakened in her Key West hotel room by the call from Miami. Her exercise sweat suit was hardly her usual working attire. The sweats hid the assets of a shapely, finely tuned body that looked more like twenty than thirty.) Inside the case was a collection of cameras, both still and video. She selected three of the cameras, popped a couple of M & Ms from an old package into her mouth, and approached the beach. As she walked across the sand toward the people and the beached whales, Carol stopped occasionally to photograph the scene.

Carol first approached a man wearing a uniform from the South Florida Marine Research Center. He was facing the ocean and talking to two Naval officers from the Marine Patrol section of the U.S. Naval Air Station in Key West. A dozen or so local volunteers were in close orbit around the speakers, keeping their distance but listening intently to the discussion. Carol walked up to the man from the research center and took him by the arm.

"Good morning, Jeff," she said.

He turned to look at her. After a moment a vague smile of recognition crossed his face.

"Carol Dawson, Miami Herald," she said quickly. "We met one night at MOI. I was with Dale Michaels."

“Sure, I remember you,” he said. “How could I forget a gorgeous face like yours?” After a moment he continued, “But what are you doing here? As far as I know, nobody in the world knew these whales were here until an hour ago. And Miami is over a hundred miles away.”

Carol laughed, her eyes politely acknowledging and thanking Jeff for the compliment. She still didn’t like it but had grudgingly grown to accept the fact that people, men especially, remembered her for her looks.

“I was already in Key West on another story, Dale called me this morning as soon as he heard about the whales. Can I interrupt you for just a minute and get some expert comments? For the record, of course.”

As she was speaking, Carol reached down and picked up a video camera, one of the newest models, a 1993 SONY about the size of a small notebook, and began interviewing Dr. Jeff Marsden, “the leading authority on whales in the Florida Keys.” The interview was standard stuff, of course, and Carol could have herself supplied all the answers. But Ms. Dawson was a good reporter and knew the value of an expert in situations like this.

Dr. Marsden explained that marine biologists still did not understand the reasons for whale beachings, although their increased frequency in the late eighties and early nineties had provided ample opportunities for research. According to him, most experts blamed the beachings on infestations of parasites in the individual whales leading each of the unfortunate pods. The prevailing theory suggests that these parasites confuse the intricate navigation systems telling the whales where to go. In other words, the lead whale somehow thinks his migration path is onto the beach and across the land; the others follow because of the rigorous hierarchy in the pod.

“I’ve heard some people say, Dr. Marsden, that the increase in whale beachings is due to us and our pollution. Would you care to comment on the accusation that our wastes as well as our acoustic and electronic pollution have undermined the sensitive biosystems that the whales use to navigate?”

Carol used the zoom on her tiny video camera to record the furrowing of Jeff Marsden’s brow. He was clearly not expecting such a leading question from her this early in the morning.

After thinking for a moment, he answered. “There have been several attempts to explain why there are so many more beachings now than were recorded in the past. Most researchers come to the inescapable conclusion that something in the whales’ environment has changed in the last half-century. It is not too farfetched to imagine that we may well have been responsible for the changes.”

Carol knew she had the right quotes for a perfect short piece for television. She then quickly and professionally wrapped up the interview, thanked Dr. Marsden, and walked over to the onlookers. In a minute she had plenty of volunteers to take her out into the lagoon so that she could take some close-up photographs of the confused whales. Within five minutes not only had Carol finished several discs of still photographs, but she also had rigged up her video camera with a stabilizing tripod on one of the little boats and done a video clip of herself explaining the beachings.

Before leaving the beach at Deer Key, Carol Dawson opened up the back of her station wagon. It served her well as a portable photo laboratory. She first rewound and checked the video tape that she had taken, listening particularly to hear if the splashing of the whales could be heard behind her while she was in the boat. Then she popped the discs from the still cameras into readers to see if she liked all the photographs. They were good. She smiled to herself, closed the back of the station wagon, and drove back to Key West.

CAROL finished the redundant transfer of the videotape through the modem to Joey Hernandez in Miami and then called another number. She was sitting in one of the private cubicles inside the large new communications room at the Key West Marriott. The screen in front of Carol indicated that the connection for her new number had been made, but there was not yet any picture. She heard a woman's voice say, "Good morning, Dr. Michaels' office."

"Good morning, Bernice, it's Carol. I'm on video."

The monitor cleared up in a second and a pleasant middle-aged woman appeared. "Oh, hi, Carol. I'll tell Dale you're on the line."

Carol smiled as she watched Bernice swivel her chair and roll over to a panel of buttons on her left. Bernice was almost surrounded by her desk. In front of her were a couple of keyboards connected to two large screens, a variety of disc drives, and what looked like a phone embedded in another monitor. Apparently there had been no room for the communications panel right next to the phone, so Bernice had to roll three to four feet in her chair to signal to Dr. Dale Michaels that he had a call, that it was on video, that it was Carol, and that it was coming from Key West. Dr. Dale, as he was known by everyone except Carol, liked to have plenty of information before he answered the phone.

Both to Bernice's left and right were perpendicular extensions to the desk, upon which were arrayed stacks of floppy discs of different sizes (the stacks were labeled "read" or "file" or "outgoing correspondence"), interleaved with groups of magazines and manila folders containing hard copy printout from the computers. Bernice pushed a button on the panel but nothing happened. She looked apologetically at Carol on the screen above the phone.

"I'm sorry, Carol." Bernice was a little flustered. "Maybe I didn't do it right. Dr. Dale had a new system installed this week again and I'm not certain . . ."

One of the two large monitors flashed a message. "Oh good," Bernice continued, now smiling, "I did it right. He'll be with you in a minute. He has someone in there with him and will finish quickly so he can see you and speak with you. I hope you don't mind if I put you on hold."

Carol nodded and Bernice's image faded away from the screen. On the monitor Carol now watched the beginning of a short tutorial documentary on oyster farming. The piece was beautifully filmed underwater using the most advanced photographic equipment. The narration featured the mellifluous voice of Dr. Dale and the video pointed out the connection between the inventions at MOI (the Miami Oceanographic Institute, of which Dr. Dale Michaels was the founder and chief executive officer) and the rapid rise of sea farming of all kinds. But Carol had to laugh. Playing quietly behind the narration, and increasing in volume during periods of narrative silence, was Pachelbel's "Canon." It was Dale's favorite piece of mood music (he was so predictable — Carol always knew what was coming next when Dale put Pachelbel on the CD player in his apartment), but it seemed strange to her to listen to the lilting strings as the cameras moved in for close-ups of growing oysters.

The oyster story was abruptly discontinued in medias res and the screen dissolved to the interior of a large executive office. Dale Michaels was sitting on a couch, across the room from his modem desk, looking at one of three video monitors that could be seen in the room. "Good morning again, Carol," he said enthusiastically. "So how did it go? And where are you? I didn't know that they had videos in the Marriott rooms yet."

Dr. Michaels was tall and slim. Blond, his hair was slightly curly and receding just a trace at the temples. He flashed a ready smile that was too quick, almost practiced, but his green eyes were warm and open.

"I'm down in the comm room here at the hotel," Carol answered. "I just sent the whale beaching story off to the Herald on disc. Jesus, Dale, I felt so

sorry for those poor animals. How can they be so smart and still get their directions so fouled up?"

"We don't know, Carol," Dale replied. "But remember that our definition of intelligence and the whales' definition are almost certainly completely different. Besides, it's not that surprising that they trust their internal navigation system even when it leads them to disaster. Can you imagine a situation in which you would essentially disregard information that your eyes were giving you? It's the same thing. We're talking here about a malfunction in their primary sensor."

Carol was quiet for a moment. "I guess I can see what you're saying," she said finally, "but it hurt to see them so helpless. Oh, well, anyway, I got the story on video too. Incidentally, the new integrated video technology is superb. The Marriott here just installed a new higher data rate modem for video and I was able to transfer the entire eight-minute piece to Joey Hernandez at Channel 44 in only two minutes. He loved it. He does the noon news, you know. Catch it if you can and tell me what you think."

Carol paused just a beat. "And by the way, Dale, thanks again for the tip."

"Just glad to help." Dale was beaming. He loved it when he could help Carol with her career. He had been pursuing her single-mindedly, in his left brain scientific way, for almost a year and a half. But he had been unable to convince her that a permanent relationship would be mutually beneficial. Or at least he thought that was the problem.

"I think this whale thing could be a great cover," Carol was saying. "You know I was worried about attracting too much attention with your telescope. And the treasure hunter bit just doesn't fit if someone down here recognizes me. But I think I can use a whale follow-up story as the pretense. What do you think?"

"Sounds reasonable to me," Dale answered. "Incidentally, there have been a couple of other whale irregularities reported as well this morning — a partial pod beaching up at Sanibel and a supposed attack on a fishing boat north of Marathon. The owner was Vietnamese and highly excitable. Of course it's almost unheard of that false killers attack anything related to humans. But maybe you can use the whole thing somehow."

Carol saw that he was already up from the couch and walking around his office. Dr. Dale Michaels had so much energy it was almost impossible for him to sit still or relax. He was just a few months away from his fortieth birthday but he still had the zest and enthusiasm of a teenager.

"Just try not to let anyone from the Navy know that you have the telescope," he continued. "They called again this morning and asked for a third set of equipment. I told them the third telescope was loaned out and being used for research. Whatever it is that they're looking for must be very important." He turned and looked at the camera. "And very secret. This guy Lieutenant Todd reminded me again this morning, as soon as I made a normal scientific inquiry, that it was Navy business and he couldn't tell me anything about it."

Carol made some notes on a small spiral pad. "You know, Dale," she began again, "I thought this story had tremendous potential as soon as you mentioned it to me yesterday. Everything indicates that something unusual and secret is going on with the Navy. I myself was amused by the amateur way that Todd stonewalled me on the phone yesterday and then demanded to know who had given me his name. I told him that a source in the Pentagon had suggested that there was some high-priority activity at the Naval Air Station in Key West and that he, Todd, was associated with it. He seemed to buy it. And I'm convinced that the bozo Navy public affairs guy here knows nothing at all about anything that might be happening."

Carol yawned and quickly put her hand over her mouth. "Well, it's too late to go back to bed. I guess I'll exercise and then go find that boat we

talked about. I feel as if I'm looking for a needle in a haystack, but your guess could be right. Anyway, I'll start with the map you gave me. And if they really have lost a cruise missile somewhere down here and are trying to cover it up, it would certainly be a great scoop for me. Talk to you later."

Dale waved good-bye and hung up. Carol left the communications area and walked out to the end of the hotel. She had an oceanfront room on the first floor. The Herald wouldn't pay for that kind of luxury, but she had decided to splurge anyway this time and pamper herself. As she was changing into her skin-tight workout swimsuit, she mused to herself about her conversation with Dale. Nobody would ever know, she thought, that Dale and I are lovers. Or at least sex partners It's all so businesslike. As if we're teammates or something. No darlings or dears. She paused for a moment and then completed her thought. Did I make it that way? she wondered.

It was almost nine o'clock and the resort was in the process of waking up when Carol walked out of her room and onto the hotel grounds. On the beach, the staff had just arrived and were setting out the chaises and umbrellas on the sand for the early risers. Carol walked over to the young man in charge (a typical Charlie Terrific, Carol thought sarcastically as she watched him strut along in front of his concession shack) and informed him that she was going for a long exercise swim. Twice at hotels previously she had forgotten to tell the guardians of the beach that she was going to swim a half mile away from the shore. Both times she had been "rescued," much to her dismay, and had created an untoward scene.

As Carol worked into the rhythm of her freestyle stroke, she began to feel the release of tension, the loosening of the knots that bound her most of the time. Although she told most other people that she exercised regularly to stay fit, the real reason Carol spent at least forty-five minutes each morning running, swimming, or walking briskly was that she needed the exercise to deal with her fast-paced life. Only after hard exercise could she really feel calm and at peace with her world.

It was normal for Carol to let her mind drift idly from subject to subject while she was swimming long distances. This morning she remembered swimming long ago in the cold waters of the Pacific Ocean near Laguna Beach in California. Carol had been eight years old at the time and had gone to a birthday party given by a friend, Jessica was her name, whom Carol had met at soccer camp during the summer. Jessica was rich. Her house had cost more than a million dollars and Jessica had more toys and dolls than Carol could possibly imagine.

Hmm, Carol was thinking as she recalled Jessica's party and the clowns and the ponies. That was when I still believed in fairy tales. That was before the separation and divorce . . .

Her watch alarm sounded, breaking her reverie, and Carol turned around in the water and headed back to shore. As she did so, she saw something strange out of the corner of her eye. No more than twenty yards from her a great whale broke the water, sending chills down her spine and adrenaline rushing into her system. The whale disappeared underwater and, despite the fact that Carol treaded water for a couple of minutes and scanned the horizon, she never saw him again.

At length Carol began swimming back toward shore. Her heart rate had started to return to normal after the bizarre encounter and now she was thinking about her lifelong fascination with whales. She remembered having a toy whale from Sea World, in San Diego, when she was seven. What was his name? Shammy. Shamu. Something like that. Then Carol remembered an earlier experience, one she had not thought about for twenty-five years.

Carol was five or six and sitting in her room, ready for bed as requested, and her father came into the room carrying a picture book. They sat together on

the bed and leaned against the wallpaper with yellow flowers while he read to her. She loved it when he put his arm around her and turned the pages in her lap. She felt protected and comfortable. He read to her a story about a whale that seemed human and a man named Captain Ahab. The pictures were frightening, one in particular showed a boat being tossed about by a giant whale with a harpoon stuck in his back.

When her father tucked her in that night he seemed to linger in the room, showering her with tender hugs and kisses. She saw tears in his eyes and asked him if anything was wrong. Her father just shook his head and told her that he loved her so much, sometimes it made him cry.

Carol was so deep in this vivid memory that she wasn't paying attention to where she was swimming. She had drifted west with the current and could now barely see the hotel. It took her a few minutes to orient herself and head back in the right direction.

3

LIEUTENANT Richard Todd waited impatiently while the data processing assistant made the last corrections on the master sheets. "Come on, come on. The meeting is supposed to start in five minutes. And we have a couple more changes to make."

The poor girl was clearly hassled by the Navy officer hanging over her shoulder while she worked at the design monitor. She corrected a couple of spelling errors on one sheet and pushed the return key. On the screen in front of her appeared a computer line-drawn map of South Florida and the Keys. With a light pen she tried to follow Lieutenant Todd's instructions and highlight the specific areas described by him.

"There," he said finally, "that's good. That finishes the group. Now hit the hard copy repro button. What's the initial key? 17BROK01? Good. On the Top Secret data base? All right. Today's password?"

"Matisse, Lieutenant," she answered, standing up to walk around the machine and pick up a single collated hard copy of his presentation. Todd had a blank look on his face. "He was a French painter," the girl said sarcastically, "M-A-T-I-S-S-E, in case you're wondering."

Todd signed out for his copy of the material and then scribbled the spelling of Matisse on a sheet of scratch paper. He awkwardly thanked the girl in a minimal way and left the room, heading out of the building and across the street.

The conference center for the U.S. Naval Air Station in Key West was next door. It was a brand-new building of modem design, one of the few edifices on the base to break the architectural monotone that could best be described as "white stucco, World War II." Lieutenant Todd worked in one of the nondescript white buildings as head of Special Projects for the site. Todd and his group were essentially troubleshooters for the command, crackerjack systems engineers who were moved from project to project depending upon where they were needed. Todd himself was twenty-eight, an Annapolis graduate in aerospace engineering, a gung-ho Navy bachelor who had grown up in Littleton, a suburb of Denver in Colorado. Todd was ambitious and in a hurry. He felt as if he were out of the mainstream down here in Key West and longed for a chance to move to somewhere he could really prove his mettle, a weapons design center, for example, or even the Pentagon.

The sign on the door in the conference center read TOP SECRET — BROKEN ARROW. Lieutenant Todd checked his watch. One minute remained before 0930, the time for the meeting. He entered an alphanumeric code into the door lock and walked into the back of a midsized conference room with three large screens in the front. His group of five younger officers and a couple of members of the

senior staff had already arrived. They were standing around the coffee and donuts that were on a table at the left. Commander Vernon Winters was sitting alone at the center of a long table that ran across the room and virtually bisected it. He was facing the screens with his back to the entrance.

"All right, all right," Winters said, first looking around the room and then at the digital time printout in the upper left corner of the front wall, "let's get started. Are you ready Lieutenant Todd?" The other officers sat down at the table. At the last minute another senior staff officer entered the room and took a seat in one of the chairs at the back.

Todd walked around the table to the front of the room, to a podium with a built-in keyboard underneath a small monitor, and eyed Commander Winters. "Yes, sir," he answered. He activated the computer system in the podium. Todd indicated that he wanted access to the Top Secret Data Base. He then entered a complicated keyed input that was the first pan of a password system. The interactive monitor in the podium next requested the password of the day. Todd's first attempt was unsuccessful, for he hadn't remembered the correct spelling. He began to search his pockets for the piece of scrap paper.

The only other keyboard in the room was in the center of the long table where Winters was sitting. While Lieutenant Todd fumbled around at the podium, the commander smiled, entered the password, and then added some code of his own. The center screen came alive in vivid color and showed a stylized woman in a yellow dress, sitting at a piano, while two young boys played checkers behind her. A sense of red flooded forth from the picture. It was a reproduction of one of Matisse's paintings from his late years in Nice and was magnificently projected at the front of the room. Lieutenant Todd looked startled. A couple of the senior officers laughed.

Winters smiled engagingly. "There are some fairly amazing things that can be done with the resolution power of a 4K-by-4K image and a nearly infinite data base." There was an awkward silence and then Winters continued. "I guess it's hopeless to keep trying to expand the education of you young officers on this base. Go on. Continue. I've put you already into the Top Secret Data Base and any new input will override the picture."

Todd composed himself. This man Winters is certainly a queer duck, he thought. The admiral who was the commanding officer of the Key West base had assigned the commander last night to lead this important Panther missile investigation. Winters had an impressive background in missiles and in systems engineering, but whoever heard of starting such a critical meeting by calling a painting up on the screen? Todd now entered 17BROK01 and, after counting the people, the number nine. In a few seconds a machine in the back corner of the room had copies of the presentation collated and stapled for the use of the participants. Todd called his first image (entitled "Introduction and Background") to the center screen with another touch of the keyboard.

"Yesterday morning," he began, "a demonstration test for the new Panther missile was conducted over the North Atlantic. The missile was fired at 0700 from an airplane at eighty thousand feet off the coast of Labrador. It was aimed at a target near the Bahamas, one of our old aircraft carriers. After flying a normal ballistic trajectory into the region where the ship was located, the Panther was supposed to activate its terminal guidance that uses the Advanced Pattern Recognition System or APRS. The missile should then have found the aircraft carrier and, using the reaction control jets as its primary control authority, made whatever vernier corrections were necessary to impact the old carrier on the main deck."

Todd pushed a key on the podium and a line drawing map of the American east coast, including the area from Labrador through Cuba, appeared on the left screen. "The missile was a final test version," he continued, "in the exact configuration of the production flight vehicle, except for the command test set and the warhead. This was to be the longest test flight yet conducted and was

designed to demonstrate thoroughly the new 4.2 version of the software that was recently installed in the APRS. So of course the missile was not armed."

The lieutenant picked up a light pen from the podium and marked on the small monitor in front of him. His markings were immediately translated to the larger screen behind him so that everyone could easily follow his discussion. "On the screen you all can see the predicted versus actual overflight path of the bird yesterday. Here, roughly ten miles east of Cape Canaveral on what appeared to be a nominal flight, the sequencer turned on the cameras. After a couple of hundred calibration images, sort of a self-test of the APRS, the terminal guidance algorithms were activated as scheduled. As far as we can tell from the realtime telemetry, nothing strange had occurred until this time."

The right screen now showed a detailed map of south Florida and the Keys that included the target in the Bahamas. The maps on the two flanking screens remained in view during the rest of his presentation but Lieutenant Todd constantly changed the word charts in the middle to keep up with the discussion. "The a priori location of the target, which was where the cameras should first have looked for the aircraft carrier, was here at Eleuthera, in the Bahamas. The search algorithm should have fanned out in a circle from there and, if it had operated properly, found the target in about fifteen seconds. This (Todd pointed toward a dotted line on the more detailed map) should have been the impact trajectory.

"However," Todd continued dramatically, "based on the telemetry data that we have analyzed to date, it appears that the missile veered sharply westward, toward the coast of Florida, soon after the terminal guidance system was activated. We have only been able to reconstruct its path up to this point, where it was about three miles west of Miami Beach at an altitude of ten thousand feet. After that the telemetry becomes intermittent and erratic. But we do know that all the terminal guidance engines were on at the time we lost complete data. Projecting the total control authority for the missile, the area highlighted here, covering the Everglades, the Keys, and even as far south as Cuba, represents where the bird might have landed."

Lieutenant Todd paused for a second and Commander Winters, who had been writing down major points in a small notebook during the presentation, immediately jumped in and started taking charge of the meeting. "A couple of questions, Lieutenant, before we proceed," Winters began in a businesslike manner with an obvious overtone of authority. "First, why was the missile not destroyed soon after it veered off course?"

"We're not exactly certain, Commander. The command test set and the small ordnance had been installed, of course, specifically for that purpose. The change in the motion of the vehicle was so sudden and so unexpected that we reacted a little slowly at the beginning. By the time we sent the command, it's possible that we were out of range. All we know is that we never saw an explosion of any kind. We can only assume — "

"We'll come back to this operational error later," Winters interrupted him again. Todd blanched at the word "error" and fidgeted behind the podium. "Where would the impact point have been according to the guidance constants active at the time of the last complete telemetry packet? And how long is it going to take us to extract additional information from the intermittent data?"

Lieutenant Todd noted to himself that the commander was sharp. Winters had obviously been associated with anomaly investigations before. Todd then explained that if the active guidance constants had not changed again, the continued firing of the terminal engines would have brought the missile to an impact point about twenty miles south of Key West. "However," Todd added, "the constants were allowed, by the software, to change every five seconds. And they had changed in two of the last five internal data updates. So it's unlikely they stayed the same as they were when our complete telemetry terminated. Unfortunately, although all the constants — even the future predicted ones that

are being calculated by the APRS-are stored in the onboard computer, because of bandwidth limitations we only transmit the active constants with the realtime telemetry. We are now going through the dropout data manually to see if we can find out anything more about the constants."

One of the other staff officers asked a question about the probability of the missile actually having reached Cuba. Lieutenant Todd answered "very low" and then activated an electronic overlay that placed a dotted and blinking trajectory on the right screen inset map. The blinking dots followed a path that started just off Coral Gables, south of the city of Miami, and then continued across a portion of south Florida into the Gulf of Mexico, across the Keys, and finally into the ocean again. "It is along this line that we intend to concentrate our search. Unless the bird suddenly changed its mind its general heading would have been consistent with a perceived target located anywhere along this path. And since we have no reports of any land impact near a populated area, we assume that the missile landed in the Everglades or the ocean."

Lieutenant Todd had consulted briefly with Winters the previous evening on the agenda for the meeting. It had been scheduled to last only an hour, but the number of questions caused it to stretch to an hour and a half. Todd was thorough and precise in his presentation but was obviously dismayed by Winters' continued probing into the possibility of human error. The lieutenant freely admitted that they had blown the procedure to destroy the missile when it went awry, but defended his men by citing the unusual circumstances and the nearly perfect previous record enjoyed by the Panther missile. He also explained that they were going to equip their search vessels with the best possible instrumentation ("including the new ocean telescope developed by the Miami Oceanographic Institute") and begin searching the outlined areas in earnest the next day.

Winters asked many questions about the possible cause of the missile's strange behavior. Todd told him that he and his staff were convinced that it was a software problem, that some new or updated algorithm in the 4.2 version of the software had somehow scrambled both the initialization sequence and the optically stored target parameters. Winters accepted their opinion eventually, but not until he ordered them to prepare a "top down" failure modes analysis that would list every possible hardware, software, or operational error (Todd winced when Winters mentioned operations again) that could lead to the kind of problem observed.

Toward the end of the meeting Winters reiterated the secrecy of the activity and pointed out that the Broken Arrow project was to remain completely unknown to the press. "Commander," Todd broke in while Winters was explaining the press policy. The lieutenant had begun the meeting with confidence but was feeling increasingly unsettled. "Sir, I had a call late yesterday afternoon from a reporter, a Carolyn or Kathy Dawson I think, from the Miami Herald. She told me that she had heard of some special activity down here and that I was supposedly connected with it. She claimed her source was someone in the Pentagon."

Winters shook his head. "Shit, Lieutenant, why didn't you say something before this? Can't you imagine what will happen if the word gets out that one of our missiles wandered over Miami?" He paused. "What did you tell her?"

"I didn't tell her anything. But I think she is still suspicious. She called the public affairs office after she talked to me."

Winters gave an order that the existence of the Broken Arrow investigation was to be kept classified and that any and all inquiries about it were to be referred to him. He then called for the next status meeting at 1500 on the following day, Friday, by which time (he told Lieutenant Todd) the commander expected to see the results of the analysis of the intermittent telemetry, a

more complete logic breakdown of the failure modes, and a list of recent open items with the 4.2 software.

Lieutenant Richard Todd left the meeting aware that this assignment was going to have a significant impact on his career. It was clear to the lieutenant that his personal competence was already being questioned by this Commander Winters. Todd intended to respond to the challenge in a positive way. First he called a small postmortem meeting of the junior officers in his group. He told them (they were all young ensigns, just out of the university after completing a Navy ROTC program) that their collective ass was on the line. Then he defined a series of action items that would keep all of them up working for most of the night. It was imperative to Todd that he be properly prepared for the next meeting.

4

KEY West was proud of its new marina. Completed in 1992 just after the explosion in cruises had brought an influx of new visitors to the old city, the marina was thoroughly modem. Scattered around the jetties on high towers were automatic cameras that constantly surveyed the marina. These cameras and the rest of the electronic surveillance systems were just one facet of an elaborate security setup that protected the slips when the boat owners were absent. Another of the new features of the Hemmingway Marina (it was naturally named after the most famous resident of Key West) was a centralized navigation control center. Here, using a virtually automatic traffic control system, a single controller was able to pass instructions to all the vessels in the harbor and provide for efficient handling of the burgeoning water traffic.

The marina was built on Key West Bight, on what had been a decaying part of the waterfront. It had slips for almost four hundred boats and its completion changed the nature of the city’s commerce. Young professionals wanting to be near their boats at the marina quickly purchased and upgraded all the wonderful nineteenth-century houses that lined Caroline and Eaton streets on what was known as the Pelican Path. Smart shops, toney restaurants, even little theaters crowded into the area around the marina to create an atmosphere of bustle and excitement. There was even a new Japanese hotel, the Miyako Gardens, which was famous for its magnificent collection of tropical birds that played in the waterfalls and ferns of its atrium.

Just before noon Carol Dawson walked into the marina headquarters and approached the circular information desk in the middle of the large room. She was wearing a sharp silk blouse, light purple in color, and a pair of long white cotton slacks that covered the tops of her white tennis shoes. Two petite ruby and gold bracelets were wrapped around her right wrist, and a huge amethyst set in a gold basket at the end of a neck chain dangled perfectly at the vertex of the “V” in her open blouse. She looked stunning, like a well-heeled tourist about to rent a boat for the afternoon.

The young girl behind the information desk was in her early twenties. She was blonde, fairly attractive in the clean-cut American style originally typified by Cheryl Tiegs. She watched Carol with just a tinge of competitive jealously as the journalist moved purposefully across the room. “Can I help you?” she said with feigned cheer as Carol reached the desk.

“I would like to charter a boat for the rest of the day.” Carol began. “I want to go out to do a little diving and a little swimming and maybe see some of the interesting ship-wrecks around here.” She planned to say nothing about the whales until she had picked the boat.

“Well, you’ve come to the right place,” the girl responded. She turned to the computer on her left and prepared to use the keyboard. “My name is Julianne and one of my jobs here is to help tourists find the boats that are just right

for their recreational needs." Carol noted that Julianne sounded as if she had memorized the little speech. "Did you have any particular price in mind? Although most of the boats here at Hemingway are private vessels, we still do have all sorts of boats for charter and most of them meet your requirements. Assuming of course that they're still available."

Carol shook her head and in a few minutes she was handed a computer listing that included nine boats. "Here are the boats that are possible," the girl said. "As I told you, there's quite a range in price."

Carol's eyes scanned down the list. The biggest and most expensive boat was the Ambrosia, a fifty-four-footer that chartered for eight hundred dollars a day, or five hundred for a half day. The list included a couple of intermediate entries as well as two small boats, twenty-six-footers, that rented for half the price of the Ambrosia. "I'd like to talk to the captain of the Ambrosia first," Carol said, after a moment's hesitation. "Where do I go?"

"Do you know Captain Homer?" Julianne replied, a strange smile starting to form at the corner of her mouth. "Homer Ashford," she said again slowly, as if the name should be recognized. Carol's mind began going through a memory search routine. The name was familiar. Where had she heard it? A long time ago, in a news program . . .

Carol had not quite retrieved the memory when the girl continued. "I'll let them know that you're coming." Below the desk counter on the right was a huge bank of relay switches, several hundred in all, apparently connected to a speaker system. Julianne flipped one of the switches and turned to Carol. "It should only be a minute," she said.

"Vat is it, Julianne?" a booming feminine voice inquired within about twenty seconds. The voice was foreign, German Judging from the way the first word was pronounced. And the voice was also impatient.

"There's a woman here, Greta, a Miss Carol Dawson from Miami, and she wants to come down to talk to Captain Homer about chartering the yacht for the afternoon."

After a moment's silence, Greta was heard again, "Ya, okay, send her down." Julianne motioned for Carol to walk halfway around the circular desk to where a familiar keyboard was sitting in a small well on the counter. Carol had been through this process many times since the UIS (Universal Identification System) was first introduced in 1991. Using the keyboard, she entered her name and her social security number. Carol wondered which verification question it would be this time. Her birthplace? Her mother's maiden name? Her father's birth date? It was always random, selected from the twenty personal facts that were immutable and belonged to each individual. To impersonate someone now really took an effort.

"Miss Carol Dawson, 1418 Oakwood Gardens, Apt. 17, Miami Beach." Carol nodded her head. Blonde Julianne obviously enjoyed her role of checking out the prospective clients. "What was your birth date?" Carol was asked.

"December 27, 1963," Carol responded. Julianne's face registered that Carol had given the correct answer. But Carol could see something else in her face, something competitive and even supercilious, almost a "Ha-ha-de-ha-ha, I'm lots younger than you are and now I know it." Usually Carol didn't pay attention to such trivia. But for some reason, this morning she was uncomfortable about the fact that she was now thirty. She started to indicate her annoyance to smug little Julianne but thought better of it and held her tongue.

Julianne gave her instructions. "Walk out that door over there, at the far right, and walk straight until you come to Jetty Number 4. Then turn left and insert this card in the gate lock. Slip "P" as in Peter is where the Ambrosia is berthed. It's a long walk, way down at the end of the jetty. But you can't miss the yacht, it's one of the largest and most beautiful boats at Hemingway."

Julianne was right. It was quite a hike to the end of Jetty Number 4. Carol Dawson probably passed a total of thirty boats of all sizes, on both sides of the jetty, before she reached the Ambrosia. By the time Carol could discern the bold blue identifying letters on the front of the cabin, she had started to sweat from the heat and humidity of late morning.

Captain Homer Ashford walked up the gangplank to meet her when she finally reached the Ambrosia. He was in his mid to late fifties, an enormous man, well over six feet tall and weighing close to two hundred and fifty pounds. His hair was still thick, but the original black color had now almost completely surrendered to the gray.

Captain Homer's wild eyes had followed Carol's approach with undisguised lubricious delight. Carol recognized the look and her reaction was one of immediate disgust. She started to turn around and go back to the marina headquarters. But she stopped herself, realizing that it was a long walk back and that she was already hot and tired. Captain Homer, apparently sensing her disapproval by the change in her gait, changed his leer to an avuncular smile.

"Miss Dawson, I presume?" the captain said, bowing slightly with fake gallantry. "Welcome to the Ambrosia. Captain Homer Ashford and his crew at your service. "Carol reluctantly smiled. This buffoon in the outrageous blue Hawaiian shirt at least did not appear to take himself too seriously. Still slightly wary, she took the proffered Coke from his out-stretched hand and followed him along the smaller side jetty beside the boat. The two of them then descended onto the yacht. It was huge.

"We understand from Julianne that you are interested in a charter for this afternoon. We would love to take you out to one of our favorite spots, Dolphin Key." They were standing in front of the wheelhouse and the covered cabin area as they talked. Captain Homer was clearly already into his sales pitch. From somewhere nearby Carol could hear the clang of metal. It sounded like barbells.

"Dolphin Key is a marvelous isolated island," Captain Homer continued, "perfect for swimming and even nude sunbathing, if you like that sort of thing. There's also a sunken wreck from the eighteenth century not more than a couple of miles away if you're interested in doing some diving." Carol took another drink from her Coke and looked at Homer for an instant. She quickly averted her eyes. He was leering again. His peculiar emphasis on the word "nude" had somehow changed Carol's mental picture of Dolphin Key from a quiet tropical paradise to a gathering place for debauchery and peeping Toms. Carol recoiled from Captain Homer's light touch as he guided her around the side of the yacht. This man is a creep, she thought. I should have followed my first instincts and turned around.

The clang of metal grew louder as they walked past the entrance to the cabin and approached the front of the luxurious boat. Carol's journalistic curiosity was piqued; the sound seemed so out of place. She hardly paid attention as Captain Homer pointed out all the outstanding features of the yacht. When they finally had a clear view of the front deck of the Ambrosia, Carol saw that the sound had indeed been barbells. A blonde woman with her back toward them was working out with weights on the front deck.

The woman's body was magnificent, even breathtaking. As she strained to finish her repetitive presses, she lifted the barbells high over her head Rivulets of sweat cascaded down the muscles that seemed to descend in ripples from her shoulders. She was wearing a low-cut black leotard, almost backless, whose thin straps did not seem capable of holding up the rest of the outfit. Captain Homer had stopped talking about the boat. Carol noticed that he was standing in rapt admiration, apparently transfixed by the sensual beauty of the sweaty woman in the leotard. This place is weird, Carol thought. Maybe that's why the girl asked me if I knew these people.

The woman put the weights back on the small rack and picked up a towel When she turned around Carol could see that she was in her mid to late thirties, pretty in an athletic sort of way . Her breasts were large and taut and clearly visible in the scant leotard. But it was her eyes that were truly remarkable. They were gray-blue in color and they seemed to look right through you. Carol thought that the woman's first piercing glance was hostile, almost threatening.

"Greta," said Captain Homer, when she looked at him after her first glance at Carol, "this is Miss Carol Dawson. She may be our charter for this afternoon."

Greta did not smile or say anything. She wiped the sweat off her brow, took a couple of deep breaths, and put the towel behind her neck and over her shoulders. She squared herself off to face Carol and Captain Homer. Then with her shoulders back and her hands on her hips, she flexed her chest muscles. With each flexure her abundant breasts seemed to stretch up toward her neck. Throughout this routine her incredibly clear eyes evaluated Carol, checking out her body and clothing in minute detail. Carol squirmed involuntarily.

"Well, hello, Greta," she said, her usual aplomb strangely absent in this awkward moment, "nice to meet you." Jesus, Carol thought, as Greta just looked at Carol's outstretched hand for several seconds, let me out of here. I must be on a strange planet or having a nightmare.

"Greta sometimes likes to have fun with our customers," Captain Homer said to Carol, "but don't let it put you off." Was he irritated with Greta? Carol thought she detected some unspoken communication between Greta and Captain Homer, for at length Greta smiled. But it was an artificial smile.

"Velcome to the Ambrosia," Greta said, mimicking Captain Homer's first remarks to Carol. "Our pleasure avaits you." Greta lifted her arms over her head, watching Carol again, and began to stretch. "Come vit us to paradise," Greta said.

Carol felt Captain Homer's burly hand on her elbow, turning her around. She also thought she saw an angry glance from Homer to Greta. "The Ambrosia is the finest charter vessel in Key West," he said, guiding her back toward the stem and resuming his sales pitch. "It has every possible convenience and luxury. Giant screen cable television, compact disc player with quad speakers, automatic chef programmed with over a hundred gourmet dishes, robot massage. And nobody knows the Keys like Captain Homer. I've been diving and fishing these waters for fifty years."

They had stopped at the entrance to the cabin area in the middle of the yacht. Through the glass door Carol could see stairs descending to another level. "Would you like to come down and see the galley and the bedroom?" Captain Homer said, without a trace of the earlier suggestiveness. He was a clever chameleon, there was no doubt about that. Carol revised her earlier judgment of him as a buffoon. But what was this business with muscle-bound Greta, whoever she is, Carol wondered. And just what is going on here? Why are they so strange?

"No, thank you, Captain Ashford." Carol saw her opportunity to exit gracefully. She handed him what was left of the unfinished Coke. "I've seen enough. It's a magnificent yacht but I can tell it's much too expensive for a single woman wanting to spend a relaxing afternoon. But thanks a lot for your time and the brief tour."

She started to walk toward the gangplank to the jetty. Captain Homer's eyes narrowed, "But we haven't even discussed price, Miss Dawson. I'm certain that for someone like you we could make a special deal . . ."

Carol could tell that he was not going to let her go without some additional discussion. As she started to leave the yacht, Greta came up beside Captain Homer. "It vould give you sometink to write about for your paper," Greta said with a bizarre smile. "Sometink unusual."

Carol turned, startled. “So you recognized me?” she said, stating the obvious. The strange pair grinned back at her. “Why didn’t you say something?”

Captain Homer simply shrugged his huge shoulders. “We thought maybe you were traveling incognito, or were looking for some special fun, or maybe even were working on a story . . .” His voice trailed off Carol smiled and shook her head. Then she waved good-bye, mounted the gangplank, and turned on the jetty toward the distant marina headquarters. Who are those people? she asked herself again. Now I’m certain that I have seen them before. But where?

* * * * *

Twice Carol looked over her shoulder to see if Captain Homer and Greta were still watching her. The second time, when she was almost a hundred yards away, they were no longer in sight. She sighed with relief. The experience had definitely unnerved her.

Carol walked on slowly. She pulled the computer listing that Julianne had given her from a small purple beach bag. Before she could look at it, she heard a telephone ring on her left and her eyes lifted naturally to follow the sound. The telephone was ringing on a boat just in front of her. A husky man in his early thirties was sitting in a folding chair on the same boat. Wearing only a red baseball cap, a pair of swim trunks, dark sunglasses and some thongs, the man was intently watching a small television propped up on a flimsy tray of some kind. He held a sandwich in one hand (Carol could see the white mayonnaise oozing out between the slices of bread even from her distance of ten yards or so) and a can of beer in the other. There was no sign that the man in the red cap even heard the telephone.

Carol moved closer, a little curious. A basketball game was in progress on the television. On about the sixth ring of the phone, the man gave a small cheer (with his mouth full of sandwich) in the direction of the six-inch picture tube, took a swig from his beer, and abruptly jumped up to answer the call. The telephone was underneath a canopy in the center of the boat, on a wooden paneled wall behind the steering wheel and next to some built-in counters that appeared to contain the navigation and radio equipment for the boat. The man fiddled with the steering wheel unconsciously during the brief conversation and never took his eyes off the television. He hung up, issued another short cheer, and returned to his folding chair.

Carol was now standing on the jetty, just inches away from the front of the boat and no more than ten feet away from where the man was sitting. But he was oblivious to her, totally absorbed in his basketball game. “All right,” he shouted all at once, reacting to something pleasing in the game. He jumped up. The sudden movement caused the boat to rock and the jerrybuilt tray underneath the television gave way. The man reached out quickly and grabbed the TV before it hit the ground, but in so doing he lost his balance and fell forward on his elbows.

“Shit,” he said to himself, wincing from the pain. He was lying on the deck, his sunglasses cocked sideways on his head, the game still continuing on the little set in his hands. Carol could not suppress her laughter. Now aware that he was not alone for the first time, Nick Williams, the owner and operator of the Florida Queen, turned in the direction of the feminine laugh.

“Excuse me,” Carol began in a friendly way, “I just happened to be walking by and I saw you fall . . .” She stopped. Nick was not amused.

“What do you want?” Nick fixed her with a truculent glare. He stood up, still holding (and watching) the television and now trying as well to put the tray back together. He didn’t have enough hands to do everything at once.

“You know,” Carol said, still smiling, “I could help you with that, if it wouldn’t injure your masculine pride.” Uh oh, Nick thought in a flash, Another pushy, assertive broad.

Nick put the television down on the deck of the boat and began to reassemble the tray. “No thank you,” he said. “I can manage.” Obviously ignoring Carol, he set the TV back on the tray, returned to his folding chair, and picked up his sandwich and beer.

Carol was amused by what Nick had clearly intended as a putdown. She looked around the boat. Neatness was not one of the strengths of the proprietor. Little odds and ends, including masks, snorkels, regulators, towels, and even old lunches from fast-food restaurants were scattered all over the front of the boat. In one of the corners someone had obviously taken apart a piece of electronic equipment, perhaps for repair, and left the entire works a jumbled mess. Mounted on the top of the blue canopy were two signs, each with a different type of print, one giving the name of the boat and the other saying THANK YOU FOR NOT SMOKING.

The boat looked out of character for the sleek modern marina and Carol imagined the other boat owners reacting with disgust each day as they passed the Florida Queen. On an impulse Carol looked at the computer listing in her hand. She almost laughed out loud when she saw the boat listing as one of the nine available for hire.

“Excuse me,” she began, intending to start the discussion about chartering the boat for the afternoon.

Nick heaved an exaggerated sigh and turned away from his televised basketball game. The miffed look on his face was unmistakable. It said, What? Are you still here? I thought we’d finished our conversation. Now go away and let me enjoy the afternoon on my boat.

Mischievous Carol couldn’t resist the opportunity to harass the arrogant Mr. Williams (she assumed that the name on the computer listing and the man in front of her were the same, for she couldn’t imagine a crew member acting with such apparent confidence and authority on someone else’s boat). “Who’s playing?” she said cheerfully, as if she had no idea that Nick was trying to get rid of her.

“Harvard and Tennessee,” he answered gruffly, amazed that Carol hadn’t got the message.

“What’s the score?” she said quickly, now enjoying the game she had just created.

Nick turned around again, his quizzical look acknowledging his exasperation. “It’s 31-29 Harvard,” he said sharply, “just before the end of the first half.” Carol didn’t move. She simply smiled and returned his fierce stare without blinking. “And it’s the first round of the NCAA tournament and they’re playing in the Southeast Regional. Any more questions?”

“Just one,” she said. “I would like to charter this boat for the afternoon. Are you Nick Williams?”

He was taken by surprise. “Whaat?” Nick said. At that minute Tennessee tied the basketball game again, distracting Nick even further. He watched the game for a couple of seconds and then tried to collect himself. “But I have had no calls from Julianne. Anyone who wants to charter a boat here at Hemingway has to sign in at the desk and . . .”

“I came down to look at another boat first. I didn’t like it. So I stopped by here on the way back.” Nick was watching the television again and Carol was losing her patience with him. At first he had been amusing. At least I don’t have to worry about his pawing me, she thought. The guy can’t even concentrate on me enough to get his boat chartered. “Look,” she added, “do you want a charter for this afternoon or not?

The first half of the basketball game ended. “All right . . . I guess so,” Nick said slowly, thinking to himself, only because I need the money. He gestured to Carol to descend onto the deck of the boat. “Let me just call Julianne and make sure you’re legit. You never know these days.”

While Nick confirmed Carol's identification with the marina headquarters, a jaunty young black man in his early twenties came down the jetty and stopped just opposite the Florida Queen. "Hey, Professor," he said, the moment Nick was off the phone, "am I in the wrong place?" He motioned to Carol. "You didn't tell me you were entertaining beauty, style, and class today. Wooee! Look at that jewelry. And that silk blouse. Should I go now and come back to hear your stories later?" He winked at Carol. "He's no good, angel. All his girlfriends eventually end up with me."

"Cut the crap, Jefferson," Nick reacted, "this woman is a potential customer. And you're late, as usual. How do you expect me to run a charter dive boat when I don't have any idea when or if my crew is going to show up?"

"Professor," the newcomer jumped down on the boat and walked up to Carol, "if I had known that you had something that looked like this down here, I would have been here before dawn. Hello, there, young lady, my name is Troy Jefferson. I am the rest of the crew on this lunatic asylum of a boat."

Carol had been slightly discombobulated by the arrival of Troy and the quick repartee that followed. But she adapted swiftly and regained her composure. She took Troy's out-stretched hand and smiled. He immediately leaned up and almost brushed his cheek against hers. "Oooeee," Troy pulled back grinning. "I just caught a whiff of Oscar de la Renta. Professor, didn't I tell you this woman had class? Well, angel," he looked at Carol in mock admiration, "I just can't tell you how much it means to me to finally meet up with someone like you on this tub. Usually we get old ladies, I mean old ladies, who want to – "

"Enough, Jefferson," Nick interrupted him. "We have work to do. It's almost noon already and we're still at least half an hour away from being ready to leave. We don't even know what Miss Dawson wants to do."

"Carol is fine," she said. She paused for a moment, assessing the two men in front of her. Might as well, Carol thought, nobody is going to suspect anything if I'm with these two. "Well, I told the desk that I wanted to go out to do some swimming and diving. But that's only partially true. What I really want to do is go out here (she pulled a folded map out of her beach bag and showed them an area of about ten square miles in the Gulf of Mexico to the north of Key West) and look for whales."

Nick's brow furrowed. Troy peered over Carol's shoulder at the map. "There have been numerous irregularities in the behavior of whales in this area lately, including a major beaching at Deer Key this morning," Carol continued. "I want to see if I can find any pattern in their actions. I may need to do some diving so one of you will have to accompany me. I assume that at least one of you is a licensed diver and that your dive gear is onboard?"

The two men regarded her with disbelieving stares. Carol felt on the defensive. "Really . . . I'm a reporter." she said as an explanation. "I work for the Miami Herald. I just did a story this morning on the Deer Key beaching."

Troy turned to Nick. "Okay, Professor, I guess we have a live charter here. One who says she wants to look for whales in the Gulf of Mexico. What do you say? Should we accept her money?"

Nick shrugged his shoulders indifferently and Troy took it as assent. "All right, angel," Troy said to Carol, "we'll be ready in half an hour. We're both licensed divers if we're really needed. Our gear is onboard and we can get more for you. Why don't you pay Julianne at the desk and get your things together."

Troy turned and walked over to the jumbled mess of electronics at the front of the boat. He picked up one of the boxes with its housing partially removed and began toying with it. Nick pulled another beer out of the refrigerator and opened the built-in counters, exposing racks of equipment. Carol did not move. After about twenty seconds Nick noticed that she was still

there. “Well,” he said in a tone of dismissal, “didn’t you hear Troy? We won’t be ready for half an hour.” He turned around and walked toward the back of the boat.

Troy looked up from his repair work. He was amused by the friction already developing between Nick and Carol. “Is he always so pleasant?” Carol said to Troy, nodding in Nick’s direction. She was still smiling but her tone conveyed some irritation. “I have a few pieces of equipment that I want to bring onboard. Can you give me a hand with it?”

Thirty minutes later Troy and Carol returned to the Florida Queen. Troy was grinning and whistling “Zippity-Do-Dah” as he pulled a cart down the jetty and came to a stop in front of the boat. A partially filled footlocker was resting on the cart. Troy could hardly wait to see Nick’s face when he saw Carol’s “few pieces of equipment.” Troy was excited by the turn of events. He knew that this was no casual afternoon charter. Reporters, even successful ones (and Troy’s street intelligence had quickly informed him that Carol was not just an ordinary reporter), did not have everyday access to the kind of equipment that she was carrying. Already Troy was certain that the whale story was just a cover. But he wasn’t going to say anything just yet; he wanted to wait and see how things developed.

Troy liked this confident young woman. There was not a trace of superiority or prejudice in her manner. And she had a good sense of humor. After they had opened the back of her station wagon and she had showed him the footlocker full of equipment, Troy had demonstrated to Carol that he was fairly sophisticated about electronics. He had recognized immediately the MOI insignia on Dale’s ocean telescope and Troy had even guessed the meaning of the MOI-IPL acronym on the back of the large monitor and data storage system. When he had looked at her for an explanation, Carol had just laughed and said, “So I need some help finding the whales. What can I say?”

Carol and Troy had loaded the gear on the cart and wheeled it through the parking lot. She had been a little dismayed at first by Troy’s recognition of the origin of the equipment and his friendly, probing questions (which she handled adroitly with vague answers — she was helped by the fact that Troy wanted mostly to know how the electronics worked and she, in truth, didn’t have the foggiest idea). But as they talked, Carol developed a comfortable feeling about Troy. Her intuitive sense told her that Troy was an ally and could be counted on to be discreet with any important information.

Carol had not, however, planned for a security check inside the Hemingway Marina headquarters. One of the primary selling points of the slips at the new marina had been the almost unparalleled security system offered the boat owners. Every person who went in or out of the marina had to pass through computerized gates adjacent to the headquarters building. A full listing of each individual entrance and exit, including the time of passage through the gate, was printed out each night and retained in the security office files as a precaution in case any suspicious or untoward events were reported.

Materiel entering and leaving the marina was also routinely scrutinized (and logged) by the security chief to prevent the theft of expensive navigation equipment and other electronics. Carol was only mildly irked when, after she paid for the charter, Julianne asked her to fill out a sheet describing the contents of the closed footlocker. But Carol really objected when the summoned security chief, a typical Boston Irish policeman who had retired in the Key West area, Forced her to open the locker to verify the contents. Carol’s objections and Troy’s attempts to help her were to no avail. Rules were rules.

Because the cart would not fit through the door into the adjacent security office, the footlocker was opened in the main clearing room of the marina headquarters. A couple of curious passersby, including one giant, friendly woman about forty named Ellen (Troy knew her from somewhere, probably she was

one of the boat owners, Carol thought), came over and watched while Officer O'Rourke carefully compared the contents of the locker with the list that Carol had prepared.

Carol was a little rattled as she and Troy pulled the cart down the jetty toward the Florida Queen. She had hoped to attract as little attention as possible and she was now angry with herself for not anticipating the security check. Nick, meanwhile, after performing a few routine preparations on the boat and opening another beer, had become engrossed again in the basketball game. His beloved Harvard was now losing to Tennessee. He did not even hear Troy's whistling until his crewman and Carol were just a few yards away.

"Jesus," Nick turned around, "I thought you had gotten lost . . ." His voice trailed off as he saw the cart and the foot-locker. "What the fuck is that?"

"It's Miss Dawson's equipment, Professor," Troy answered with a big grin. He reached into the locker, first picking up a cylinder with a clear glass face, a large flashlight-looking object on a mounting bracket. It was about two feet long and weighed about twelve pounds. "Here, for example, is what she tells me is an ocean telescope. We attach it to the bottom of the boat by this bracket and it takes pictures that are displayed on this here television monitor and also stored on this other device, a recorder of some – "

"Hold it," Nick interrupted Troy imperiously. Nick walked up the gangplank and stared incredulously into the locker. He shook his head and looked from Troy to Carol. "Do I have this right? We are supposed to set up all this shit just to go out into the Gulf for one afternoon to look for whales?" He scowled at Troy. "Where is your head, Jefferson? This stuff is heavy, it will take time to set it up, and it' s already after noon.

"And as for you, sister," Nick continued, turning to Carol, "take your toys and your treasure map elsewhere. We know what you're up to and we have more important things to do."

"Are you through?" Carol shouted at Nick as he walked back down the gangplank onto the Florida Queen. He stopped and turned partially around. "Look, you asshole." Carol raged, giving vent to the frustration and anger that had been building inside of her, "it is certainly your right to deny me the use of your boat. But it is not your right to act like God almighty and treat me or anyone else like shit just because I'm a woman and you feel like pushing somebody around." She stepped toward him. Nick backed up a step in the face of her continued offensive.

"I told you that I want to look for whales and that's what I intend to do. What you might think I'm doing is really of no significance to me. As for the important things that you have to do, you haven't moved from that goddamn basketball game in the last hour, except to get more beer. If you'll just stay out of the way. Troy and I can set all this gear in place in half an hour. And besides," Carol slowed down just a bit, starting to feel a little embarrassed about her outburst, "I have already paid for the charter and you know how hard it is to straighten out these computer credit card accounts."

"Oooeee, Professor," Troy grinned wickedly and winked at Carol. "Isn't she something else?" He stopped and became serious. "Look, Nick, we need the money, both of us. And I would be happy to help her. We can take off some of the excess diving gear if it's necessary to balance the weight."

Nick walked back to the folding chair and the television. He took another drink from his beer and did not turn around to look at Carol and Troy. "All right," he said, somewhat reluctantly. "Get started. But if we're not ready to sail by one o'clock it's no deal." The basketball players swam in front of his eyes. Harvard had tied the game again. But this time he wasn't watching. He was thinking about Carol's outburst. I wonder if she's right. I wonder if I do think that women are inferior. Or worse.

COMMANDER Vernon Winters was trembling when he hung up the phone. He felt as if he had just seen a ghost. He threw his apple core in the wastebasket and reached in his pocket for one of his Pall Malls. Without thinking, he stood up and walked across the room to the large bay window that opened onto the grassy courtyard of the main administration building. Lunch hour had just finished at the U.S. Naval Air Station. The crowds of young men and women heading either toward or away from the cafeteria had died out. A solitary young ensign was sitting on the grass reading a book, his back against a large tree.

Commander Winters lit his nonfilter cigarette and inhaled deeply. He expelled the smoke with a rush and quickly took another breath. “Hey, Indiana,” the voice had said two minutes before, “this is Randy. Remember me?” As if he could ever forget that nasal baritone. And then, without waiting for an answer, the voice had materialized into an earnest face on the video monitor. Admiral Randolph Hilliard was sitting behind his desk in a large Pentagon office. “Good,” he continued, “now we can see each other.”

Hilliard had paused for a moment and then leaned forward toward the camera. “I was glad to hear that Duckett put you in charge of this Panther business. It could be nasty. We must find out what happened, quickly and with no publicity. Both the secretary and I are counting on you.”

What had he said in response to the admiral? Commander Winters couldn’t remember, but he assumed that it must have been all right. And he did remember the last few words, when Admiral Hilliard had said that he would call back for an update after the meeting on Friday afternoon. Winters had not heard that voice for almost eight years but the recognition was instantaneous. And the memories that flooded forth were just a few milliseconds behind.

The commander took another drag from his cigarette and turned away from the window. He walked slowly across the room. His eyes slid across but did not see the lovely, soft print of the Renoir painting, “Deux Jeunes Filles au Piano,” that was the most prominent object on his office wall. It was his favorite painting. His wife and son had given him the special large reproduction for his fortieth birthday; usually several times a week he would stand in front of it and admire the beautiful composition. But two graceful young girls working on their afternoon piano lessons were not the order for the day.

Vernon Winters sat back down at his desk and buried his face in his hands. Here if comes again, he thought, I can’t hold it back now, not after seeing Randy and hearing that voice. He looked around and then stubbed out the cigarette in the large ashtray on his desk. For a few moments he played aimlessly with the two small framed photographs on his desk (one was a portrait of a pale twelve-year-old boy together with a plain woman in her early forties; the other was a cast photo from the Key West Players production of Cat on a Hot Tin Roof, dated March 1993, in which Winters was dressed in a summer business suit). At length the commander put the photographs aside, leaned back in his chair, closed his eyes, and succumbed to the powerful pull of his memory. A curtain in his mind parted and he was transported to a clear, warm night almost eight years before, in early April of 1986. The first sound that he heard was the excited nasal voice of Lieutenant Randolph Hilliard.

“Psst, Indiana, wake up. How can you be asleep? It’s Randy. We’ve got to talk. I’m so excited I could shit.” Vernon Winters had only fallen asleep himself about an hour before. He unconsciously looked at his watch. Almost two o’clock. His friend stood next to his bunk, grinning from ear to ear. “Only three more hours and we attack. Finally we’re going to blast that A-rab lunatic and terrorist supporter to heaven with Allah. Shit, big buddy, this is our moment. This is what we worked our whole life for.”

Winters shook his head and began to come out of a deep sleep. It took him a moment to remember that he was onboard the USS Nimitz off the coast of Libya. The first action of his military career was about to occur. “Look, Randy,” Winters had said eventually (on that night almost eight years ago) “shouldn’t we be sleeping? What if the Libyans attack us tomorrow? We’ll have to be alert.”

“Shit no,” said his friend and fellow officer, helping him to sit up and handing him a cigarette, “those geeks will never attack someone who can fight. They’re terrorists. They only know how to fight unarmed people. The only one of them that has any guts is that Colonel Gaddafi and he’s nutty as a fruitcake. After we blow him to kingdom come, the battle will be over. Besides, I have enough adrenaline flowing that I could stay awake for thirty-six hours with no sweat.”

Winters felt the nicotine coursing through his body. It reawakened the eager anticipation that he had finally conquered when he had fallen asleep an hour earlier. Randy was talking a blue streak. “I can’t believe how goddamn lucky we are. For six years I have been wondering how an officer can stand out, distinguish himself, you know, in peacetime. Now here we are. Some loonie plants a bomb in a club in Berlin and we just happen to be on duty in the Med. Talk about being in the right place at the right time. Shit. Think how many other midshipmen from our class would give their right nut to be here instead of us. Tomorrow we kill that crazy man and we’re on our way to captain, maybe even admiral, in five to eight years.”

Winters reacted negatively to his friend’s suggestion that one of the benefits of the strike against Gaddafi would be an acceleration in their personal advancement. But he said nothing. He was already deep in his own private thoughts. He too was excited and he didn’t fully understand why. The excitement was similar to the way he had felt before the state quarterfinals in basketball in high school. But Lieutenant Winters couldn’t help wondering how much the excitement would be leavened by fear if they were preparing to engage in a real battle.

For almost a week they had been getting ready for the strike. It was normal Navy business to go through the preparations for combat and then have them called off, usually about a day ahead of the planned encounter. But this time it had been different from the beginning. Hilliard and Winters had quickly recognized that there was a seriousness in the senior officers that had never been there before. None of the usual horsing around and nonsense had been tolerated in the tedious and boring checks of the planes, the missiles, and the guns. The Nimitz was preparing for war. And then yesterday, the normal time for such a drill to be called off, the captain had gathered all the officers together and told them that he had received the order to attack at dawn. Winters’ heart had skipped a beat as the commanding officer had briefed them on the full scope of the American action against Libya

Winters’ last assignment, just after evening mess, had been to go over the bombing targets with the pilots one more time. Two separate planes were being sent to bomb the residence where Gaddafi was supposedly sleeping. One of the two chosen pilots was outwardly ecstatic; he realized that he had been given the prime target of the raid. The other pilot, Lieutenant Gibson from Oregon, was quiet but thorough in his preparations. He kept looking at the map with Winters and going over the Libyan gun emplacements. Gibson also complained that his mouth was dry and drank several glasses of water.

“Shit, Indiana, you know what’s bothering me? Those flyboys will be in the battle and we’ll be stuck here with no role unless the crazy A-rabs decide to attack. How can we get into the fight? Wait. I just had a thought.” Lieutenant Hilliard was still talking nonstop. It was after three o’clock and they had already gone over everything associated with the attack at least twice. Winters was feeling lifeless and enervated from lack of sleep but the astonishing Hilliard continued to exude exuberance.

“What a great idea,” Randy continued. talking to himself. “But we can do it. You briefed the pilots tonight, didn’t you, so you know who’s going after what targets?” Vernon nodded his head. “Then that’s it. We’ll tape a personal ‘screw you’ to the side of the missile that’s going to get Gaddafi. That way part of us will go into battle.”

Vernon did not have the energy to dissuade Randy from his crazy plan. As the time for the attack drew closer, Lieutenants Winters and Hilliard went into the hangar on the Nimitz and found the airplane assigned to Lieutenant Gibson (Winters never knew why, but he immediately assumed it would be Gibson who would score a missile on the Gaddafi enclave). Laughingly, Randy explained to the fresh ensign on watch what he and Vernon were going to try to do. It took them almost half an hour to locate the right plane and then identify the missile that would be the first to be launched against the Gaddafi household.

The two lieutenants argued for almost ten minutes about the message they were going to write on the paper that would be taped on the missile. Winters wanted something deep, almost philosophical, like “Such is the just end to the tyranny of terrorism. “Hilliard argued persuasively that Winters’ concept was too obscure. At length a tired Lieutenant Winters assented to the visceral communication written by his friend. “DIE, MOTHERFUCKER,” was the message the two lieutenants inscribed on the side of the missile.

Winters returned to his bunk exhausted. Tired and still a little unsettled by the magnitude of the coming day’s events, he pulled out his personal Bible to read a few verses. There was no comfort in the good book for the Presbyterian from Indiana. He tried praying, generic prayers at first and then more specific, as had been his custom during critical moments in his life. He asked for the Lord to guard his wife and son and to be with him in this moment of travail. And then, quickly and without thinking, Lieutenant Vernon Winters asked God to rain down terror in the form of the missile with the taped message on Colonel Gaddafi and all his family.

Eight years later, sitting in his office at the U.S. Naval Air Station in Key West, Commander Winters would remember that prayer and cringe inside. Even then, in 1986, just after he finished the prayer, he had felt weird and disoriented, almost as if he had somehow committed a blasphemy and displeased the Lord. A brief hour of sleep that followed was torturous, full of dreams of hideous gargoyles and vampires. He watched the planes leave the carrier the next morning at dawn in a dreamlike trance. His mouth had a bitter metal taste when he mechanically shook Gibson’s hand and wished him luck.

For all those years Winters had wished that he could have rescinded that prayer. He was convinced that God had permitted that particular missile carried by Gibson to take the life of Gaddafi’s infant daughter just to teach Winters a personal lesson. On that day, he thought as he sat in his office on a Thursday in March 1994, I committed sacrilege and violated Your trust. I overstepped my bound and lost my privileged position in Your sanctuary. I have asked for forgiveness many times since then but it has not been forthcoming. How much longer must I wait?

6

VERNON Allen Winters was born on June 25, 1950, the day that the North Koreans invaded South Korea. He was reminded of the significance of his birthdate throughout his life by his father, Martin Winters, a man who was a hardworking, deeply religious corn farmer in Indiana at the time Vernon was born. When Vernon was three years old and his sister Linda was six, the family moved off the farm and into the town of Columbus, a white, middle-class town of thirty thousand or so in south central Indiana. Vernon’s mother had felt isolated out on the farm. particularly during the winter, and wanted more company. The

Winters' farm provided a nice cash profit. Mr. Winters, by now almost forty, put most of the nest egg aside as security for a rainy day and became a banker.

Martin Winters was proud to be an American. Whenever Mr. Winters would tell Vernon about the day of his birth, the story would inevitably center around the news of the start of the Korean War and how it was explained to the nation by President Harry Truman. "I thought that day," Mr. Winters would say, "that it was surely no coincidence. The good Lord brought you to us that special day because of his purpose for you. And I bet he meant for you to be a protector of this wonderful country we have created . . ." Later banker Winters would always see to it that the Army-Navy football game was one of the key events of the year and he would tell his friends, particularly when it became obvious that young Vernon was a good student, that "the boy is still trying to choose which of the academies to attend." Vernon was never asked.

The Winters family lived a simple Midwestern life. Mr. Winters was moderately successful, eventually becoming the senior vice-president of the largest bank in Columbus. The family's chief social activity was church. They were Presbyterians and spent almost all day Sunday at the church. Mrs. Winters ran the Sunday school. Mr. Winters was a deacon and voluntarily managed the church finances. Vernon and Linda helped supervise the smaller children at Sunday school and were responsible for the special Bible displays on the bulletin boards in the kindergarten and primary school rooms.

During the week Mrs. Winters sewed and watched soap operas and sometimes played bridge with friends. She never worked outside the home. Her husband and her children were her job. She was an attentive, patient parent who deeply cared for her children and tirelessly chauffeured them to their many activities throughout their years of adolescence.

Vernon played all sports in high school, football and basketball because it was expected of him, baseball because he loved it. He was above average at all sports, not outstanding at anything. "Activities are important, particularly sports," banker Winters often told him approvingly. "The academies look at much more than your grades " The only significant decision that Vernon had to make in the first eighteen years of his life was which of the service academies he preferred. (Mr. Winters, being cautious, was prepared politically to secure a nomination for Vernon to any of the academies. He strongly urged Vernon to think about applying to all three just in case.) In his junior year at Columbus High School, Vernon took the Scholastic Aptitude Test (SAT) and made such a high score that it was obvious he would be able to pick his own favorite. He chose Annapolis and was not questioned about the reasons. If he had been, he would have answered that he just liked the idea of himself in a Navy uniform.

Vernon's teenage years were remarkably linear, particularly considering that they occurred at a time of great social turmoil in the United States. The Winters family prayed together for hours after the Kennedy assassination, worried about local boys in the Vietnam War, remarked with concern when three prominent high school seniors refused to cut their hair and were expelled from school, and attended a couple of church-sponsored meetings on the evils of marijuana. But all these anxieties were outside the daily harmony of the Winters family. Music by the Beatles and the Rolling Stones did penetrate the controlled Winters culture, of course, and even some of the protest songs sung by Bob Dylan and Joan Baez were played on Vernon's stereo. But neither Vernon nor his sister Linda paid much serious attention to the lyrics.

It was an easy existence. Vernon's closest friends were all from families like his. Mothers did not work, fathers were bankers or lawyers or businessmen, almost all were Republicans (but a patriotic Democrat was accepted) and believed fervently in God, country, and the entire litany that ends in apple pie. Vernon was a "good kid," even an "exceptional kid," who first drew attention to himself by his performances in the annual church pageants at Christmas and Easter. The pastor of their church was a great believer that reenactment of the birth and

crucifixion of Christ, performed by the children of the town, was a powerful way to reconfirm the faith of the local citizenry. And Reverend Pendleton was correct. The Columbus Presbyterian Church pageants were one of the highlights of the local year. When the church congregation and their friends saw their own children acting in the roles of Joseph, Mary, and even Christ, they became involved in the depicted events at an emotional level that was virtually impossible to achieve in any other way.

Reverend Pendleton had two casts for each pageant, so that more children could participate, but Vernon was always the star. When he was eleven years old Vernon first portrayed Christ in the Easter pageant and it was mentioned in the religious column of the Columbus newspaper that his tortured dragging of the cross had "captured all of man's suffering." He was Joseph at Christmas and Jesus at Easter for four years running, before he became too old and therefore no longer eligible for the pageants. The last two years, when Vernon was thirteen and fourteen, the role of the Virgin Mary in the "A" cast was played by the pastor's daughter, Betty Vernon and Betty were together quite often while rehearsing and both families were delighted. All four parents made no secret of the fact that they would generously approve if, "assuming God wills it," the Vernon-Betty friendship would eventually mature into something more permanent.

Vernon loved the attention he received from the pageants. Although Betty was touched deeply by the religious aspects of their performances (she remained truly devoted to God, without wavering, through everything in her life), Vernon's joy was standing by his proud parents after each performance and soaking up the praise. In high school he gravitated naturally toward the small drama activity and was the lead in the school play every year. His mother supported this over his father's mild objections ("After all, dear," she would say, "I don't think anyone is really going to think Vernon's a sissy when he's playing three sports.") and because she also vicariously enjoyed the applause.

During the summer of 1968, just before he entered Annapolis, Vernon worked in his uncle's cornfields. Only a little more than a hundred miles away there were riots at the Democratic Convention in Chicago, but in Columbus Vernon spent his summer evenings with Betty, talking with chums and drinking root beer at the A & W Drive-in. Mr. and Mrs. Winters played miniature golf or canasta with Vernon and Betty from time to time. They were delighted and proud to have "good clean kids" who were not hippies or drug victims. All in all, Vernon's last summer in Indiana was ordered, constrained, and very pleasant.

As expected, he was a model student at Annapolis. He studied hard, obeyed all the rules, learned what his professors taught him, and dreamed of being the commander of an aircraft carrier or a nuclear submarine. He was not outgoing for the big-city boys seemed way too sophisticated for him and he did not always feel comfortable when they talked about sex so casually. He was a virgin and he was not ashamed of it. He just didn't feel the need to broadcast it around the U.S. Naval Academy. He had a couple of dates a month, nothing special, just when the occasion called for it. After a blind date early his junior year with Joanna Carr, a cheerleader at the University of Maryland, he took her out several more times. She was vivacious, lovely, fun, and modem. She drew out the best in Vernon, made him laugh and even relax. She was his date for the weekend of the Army-Navy game in Philadelphia.

(During his entire time at the Academy, Vernon went home every summer and every Christmas to Indiana. He always saw Betty Pendleton when he was home. Betty graduated from high school and entered a nearby state college to study education. Once or twice a year, on special occasions such as the anniversary of their first kiss or New Year's Eve, Betty and he would celebrate, in a sense, by doing a little something intimate. Like controlled petting [outside only] or kissing lying down. Neither of them ever suggested any variation in this well-established routine.)

Vernon and Joanna were joined for the weekend by another midshipman, the closest acquaintance that Vernon had at Navy who was still not quite what one would call a friend, Duane Eller, and his date from Columbia, an extremely loud and pushy girl named Edith. Vernon had never spent much time around a New York City girl and he found Edith absolutely obnoxious. Edith was violently anti-Nixon and anti-Vietnam and seemed, despite the fact that her date for the weekend was going to be a military officer, anti-military as well. The original plan for the weekend had been decidedly proper, even backward given that it was 1970 and casual intercourse was not unusual on college campuses. Vernon and Duane were to share one motel room and the two girls were to share another. Over a pizza dinner the night before the game, Edith frequently insulted Joanna and Vernon both ("Miss Betty Crocker-Go-Team-Go" and "Onward Christian Soldiers, God's on Our Side") and Duane did nothing to intercede. Seeing that Edith was annoying Joanna, Vernon suggested to Joanna that it might be easier if the two of them shared a room instead of following the original game plan. She readily agreed.

Vernon had made no sexual moves on Joanna on the four or five dates that they had had together. He had been attentive, had kissed her good night a couple of times, and had held her hand most of the evening on their last date. Everything had always been extremely proper, but there had never actually been any opportunity for intimacy. So Joanna really didn't know what to expect. She liked this handsome Hoosier midshipman and had thought, a couple of times, about the possibility of the involvement developing into something serious. But Vernon was not yet anyone "super special" for her.

Just after they made the room change (which a drunken Edith made more difficult by embarrassing them and herself with lewd comments), Vernon very carefully apologized to Joanna and told her that he would sleep in the car if she were offended. The room was a typical Holiday Inn room with two double beds. Joanna laughed. "I know you didn't plan this," she said. "If I need protection, I can order you to your bed." The first night they enjoyed watching television and drinking more beer in the room. They both felt a little awkward. At bedtime they shared a couple of almost passionate kisses, laughed together, and then went to separate beds.

The next evening, after the postgame dance sponsored by the Naval Academy at a downtown Philadelphia hotel, Joanna and Vernon returned to their room at the Holiday Inn just before midnight. They had already changed into their jeans and Vernon was brushing his teeth when there was a knock on their door. Joanna opened the door and Duane Eller was standing there, a gigantic shit-eating grin on his face and his hand clenched around some small object. "This stuff is fuckin' fantastic," he said, thrusting a joint into Joanna's hand. "You've just got to try it." Duane withdrew quickly with a wild smile.

Joanna was a bright young woman. But it did not occur to her that her date had never even seen a joint, much less smoked one. She herself had smoked marijuana maybe a dozen times over a four-year period, beginning in her junior year in high school. She liked it, if the situation and the company were right; she avoided it when she couldn't have control of her environment. But she had enjoyed the weekend with Vernon and she thought this might be a perfect way to loosen him up a little.

Under almost any circumstances Vernon would have said no to any offer of marijuana, not just because he was against all drugs, but also because he would have been terrified that somehow he would be discovered and eventually thrown out of Annapolis. But here was his lovely date, a mainstream American cheerleader from Maryland, and she had just lit a joint and offered it to him. Joanna quickly saw that he was a grass neophyte. She showed him how to inhale and hold in the smoke, how not to bogart the joint, and eventually how to use a roach clip (one of her hairpins) to finish it off. Vernon had expected to feel as if he were drunk. He was astonished to find that he felt more alert. Much

to his own surprise, he began reciting e.e. cummings poems he had been studying in Lit. And then he and Joanna began to laugh. They laughed at everything. At Edith, football, the Naval Academy, their parents, even Vietnam. They laughed until they were almost crying.

An overpowering hunger attacked Vernon and Joanna. They put on their jackets and walked out into the cold December air to find something to eat. Arm in arm they paraded down the suburban parkway, finding a convenience store that was still open about a half mile from their motel. They bought Cokes and potato chips and Fritos and, much to Vernon's astonishment, a package of Ding Dongs. Joanna opened the potato chips while they were still in the store. She put one in Vernon's mouth and they "Mmmed" while the checkout clerk laughed with them.

Vernon could not believe the taste of the chips. He ate the entire bag while they were walking back to their room. When he was finished, Vernon burst spontaneously into song, singing "Maxwell's Silver Hammer" by the Beatles. Joanna joined in vigorously on the "Bang, bang, Maxwell's silver hammer came down upon his head . . ." She reached up with the side of her fist and playfully banged on the top of his head. Vernon felt jaunty, liberated, as if he had known Joanna forever. He put his arm around her and kissed her ostentatiously as they turned into the driveway leading to their motel.

They sat on the floor with all their munchies spread out in front of them. Vernon turned on the radio. It was tuned to a classical station in the middle of a symphony. Vernon was mesmerized by the sound. For the first time in his life, Vernon could actually hear the individual instruments of the orchestra in his head. He visualized a stage and saw the musicians pulling their bows across the violins. He was fascinated and excited. Vernon told Joanna that all his senses were alive.

To Joanna Carr, it seemed that Vernon was finally opening up. When he leaned over to kiss her, she was more than willing. They kissed sweetly but deeply several times while the symphony was playing. During a momentary break for some more munchies, Joanna tuned the radio to a rock and roll station. The music changed the pace in their necking. Driving, jangling sounds increased the tempo and their kisses became more passionate. In his ardor Vernon pushed Joanna down on the floor and they kissed over and over again as they lay side by side, still fully clothed. They became enthralled by the strength of their arousal.

The radio now started playing "Light My Fire" by the Doors. And Vernon Allen Winters of Columbus, Indiana, third-year midshipman at the U S. Naval Academy, was no longer a virgin by the time the long song was over. "The time to hesitate is through, no time to wallow in the mire, try now you can only lose, and our love become a funeral pyre . . . Come on baby, light my fire . . . Come on baby, light my fire." Vernon had never lost control of himself before in his entire life. But when Joanna stroked the outline of his swollen penis underneath his jeans, it was as if a giant wall of steel and concrete suddenly gave way. Years later, Vernon would still marvel at the raw passion he showed for two, maybe three minutes. The combination of Joanna's insistent kisses, the grass, and the driving rhythms of the music pushed him over the edge. He was an animal. Still on the floor of the motel room, he pulled vigorously on Joanna's slacks several times, nearly tearing them as he managed to free them from her hips. Her underpants half followed the slacks. Vernon grabbed them roughly and pulled them down the rest of the way while he was squirming out of his own jeans.

Joanna tried in a quiet voice to slow Vernon down, to suggest that maybe the bed would be better. Or at least it would be more pleasant if they actually took off their shoes and socks and didn't make love with their pants around their ankles restricting their movement. But Vernon was gone. Years of restraint left him no ability to deal with his own surging desire. He was possessed. He crawled on top of Joanna, a look of frightening seriousness on

his face. For the first time she was scared and her sudden fear heightened her sexual excitement. Vernon struggled for a few seconds (the music was now in the frenzied instrumental part of “Light My Fire”) to find the right spot and then entered her abruptly and forcefully. Joanna felt him drive once, twice, and then shudder all over. He was done in maybe ten seconds. She intuitively knew that it had been his first time and the pleasure of that knowledge outweighed her bruised feelings about his lack of finesse and gentleness.

Vernon said nothing and quickly fell asleep on the floor next to Joanna. She gamely went to the bed, pulled the bed-spread off, cuddled into Vernon’s arms on the floor, and wrapped the spread around them. She smiled to herself and drifted off to sleep, still a little puzzled by this Hoosier lying next to her. But she knew that they were now special to each other.

How special Joanna would never really know. When Vernon woke up in the middle of the night, he felt an over-powering sense of guilt. He could not believe that he had smoked dope and then virtually raped a girl he hardly knew. He had lost control. He had been unable to stop what he was doing and had clearly crossed the bounds of propriety. He winced when he thought about what his parents (or worse, Betty and Reverend Pendleton) would think about him if they could have seen what he had done. Then the guilt gave way to fear. Vernon imagined that Joanna was pregnant, that he had to leave Annapolis and marry her (What would he do? What kind of job would he have if he were not a naval officer?), that he had to explain all this to his parents and to the Pendletons. Worse still, he next imagined that at any minute the motel would be raided and the police would find the butt of the joint in the roach clip. He would first be kicked out of the Academy for drug abuse, then find out that he had made a girl pregnant.

Vernon Winters was now really scared. Lying on the floor of a motel room on the outskirts of Philadelphia at three o’clock on a Sunday morning, he began to pray in earnest. “Dear God,” Vernon Winters prayed, asking for something specific for himself for the first time since he asked God to help him on the day that he took the SATs, “let me get out of this without harm and I will become the most perfectly disciplined naval officer that You have ever seen. I will dedicate my life to defending this country that honors You. Just please help me.”

Eventually Vernon managed to fall asleep again. But his sleep was fitful and disturbed by vivid dreams. In one dream Vernon was dressed in his midshipman’s uniform but was on stage back at the Columbus Presbyterian Church. It was the Easter pageant and he was again Christ, dragging the cross to Calvary. The sharp edge of the cross on his shoulder was cutting through his uniform shirt and Vernon was aware of anxiety that he might not pass inspection. He stumbled and fell, the cross cut deeper through the uniform as he had feared and he could see some blood running down his arm. “Crucify him,” Vernon heard someone shout in the dream. “Crucify him,” a group of people in the audience shouted together as Vernon tried vainly to see through the klieg lights. He woke up sweating. For a couple of moments he was disoriented. Then again his emotions went the cycle from disgust to depression to fear as he played through the events of the night before.

Joanna was tender and affectionate after she woke up but Vernon was very distant. He explained his attitude by saying he was worried about his coming exams. A couple of times Joanna started to talk about what had happened the night before, but each time he rapidly changed the subject. Vernon suffered through brunch and the drive back to College Park to Joanna’s sorority house. Joanna tried to kiss him meaningfully when they parted but Vernon did not reciprocate. He was in a hurry to forget the entire weekend. Back in the privacy of his own room in Annapolis, he contritely bargained again with God to let him escape unscathed.

Midshipman Vernon Winters was true to his word. He not only never talked to Joanna Carr again (she called and failed to reach him a couple of times, sent two letters that were unanswered, and then gave up), he also gave up dating altogether during his final eighteen months at Annapolis. He worked very hard on his studies and attended chapel, as he had promised God, twice each week.

He graduated with honors and did his initial tour of duty on a large aircraft carrier. Two years later, in June of 1974, after Betty Pendleton had completed college and obtained her teacher's certificate, Vernon married her in the Columbus Presbyterian Church where they had played Joseph and Mary a dozen years earlier. They moved to Norfolk, Virginia, and Vernon believed that the pattern of his life was set. His life would be going out to sea for long stretches and then coming home for short stays with Betty and any children they might have.

Vernon regularly thanked God for keeping up His part of the bargain and he dedicated himself to being the finest officer in the U.S. Navy. All of his fitness reports praised his dependability and thoroughness. His commanding officers openly told him that he was admiral material. Until Libya. Or more specifically, until he returned home after the Libyan action. For the entire world changed for Vernon Allen Winters during the few weeks after the American attack against Gaddafi.

7

CAROL and Troy were sitting in deck chairs at the front of the Florida Queen. They were facing forward in the boat, toward the ocean and the warm afternoon sun. Carol had removed her purple blouse to reveal the top of a one-piece blue bathing suit, but she was still wearing her white cotton slacks. Troy was shirtless in a white surfing outfit that came quite a way down his beautiful black legs. His body was lean and sinewy, clearly fit but not overly muscled. They were talking casually and animatedly, laughing often in an easy way. Behind them underneath the canopy, Nick Williams was reading A Fan's Notes by Fred Exley. Every now and then he would look up at the other two for a few moments and then return to his book.

"So why didn't you ever go to college?" Carol was asking Troy. "You clearly had the ability. You would have made a fantastic engineer."

Troy stood up, took off his sunglasses, and walked to the railing. "My brother, Jamie, said the same thing," he said slowly, staring out at the quiet ocean. "But I was just too wild. When I finally did graduate from high school, I was hungry to know what the world was like. So I took off. I wandered all over the U.S. and Canada for a couple of years."

"Was that when you learned about electronics?" Carol asked. She checked her watch to see what time it was.

"That was later, much later," said Troy, remembering. "Those two years of wandering I didn't learn anything except how to survive on my wits. Plus what it was like to be a black boy in a white man's world." He looked at Carol. There was no noticeable reaction.

"I must have had a hundred different jobs," he continued, looking back at the ocean, "I was a cook, a copyboy, a bartender, a construction worker. I even taught swimming lessons in a private club. I was a bellman in a resort hotel, a greenskeeper for a country club . . ." Troy laughed and turned again to see if Carol was paying attention. "But I guess you're not interested in all this . . ."

"Sure I am," Carol said, "it's fascinating to me. I'm trying to imagine what you looked like in a hotel uniform. And if Chief Nick is right, we still have another ten minutes to pass until we reach where we're going." She dropped her voice. "At least you talk. The professor is not exactly social."

“Being a black bellhop at a southern Mississippi resort hotel was an amazing learning experience,” Troy began, a smile spreading across his face. Troy loved to tell stories about his life. It always placed him center stage. “Imagine, angel, I’m eighteen years old and I luck into a job at the grand old Gulfport Inn, right on the beach. Room and board plus tips. I’m on top of the world. At least until the chief bellman, an impossible little man named Fish, takes me out to the barracks where all the bellhops and kitchen staff live and introduces me to everybody as the ‘new nigger bellhop.’ From bits of discussion I can tell that the hotel is in some kind of trouble because of possible racial discrimination and hiring me is part of their response.

“My room in the barracks was right behind the twelfth green on the golf course. A small bunk bed, a dresser built into the wall, a desk or table with a portable lamp, a sink to brush my teeth and wash my face — that’s where I lived for six weeks. Down at the other end of the building was the great community bathroom that everyone left whenever I showed up.

“In my high school in Miami virtually the entire student body was Cuban or black or both. So I knew almost nothing about white people. From books and television I had this fantasy image of whites as handsome, competent, educated, and rich. Ha. My fantasy quickly vanished. You would not have believed the crew that worked in that hotel. The head bellman Fish smoked dope every night with his sixteen-year-old son Danny and dreamed of the day he would find a million dollars left in somebody’s room. His only other goal in life was to continue screwing the chef’s wife, Marie, in the supply closet every morning until he died.

“One of the other bellmen was a poor, lonely soul whose real name was Saint John because his brilliant parents thought that ‘Saint’ was a given name. He had only six teeth, wore thick glasses, and had a giant tumor underneath his left eye. Saint John knew that he was ugly and he worried all the time about losing his job because of his personal appearance. So Fish exploited him unmercifully by giving him all the shittiest assignments and forcing him to pay kickbacks with a portion of his tips. The other bellmen also ridiculed Saint John at every opportunity and made him the butt of their practical jokes.

“One night I was sitting quietly in my room reading a book when there was a soft knock on the door. When I answered it, Saint John was standing there. He looked confused and distracted. He was holding a small game box in one hand and a six-pack of beer in the other. I waited a few moments and then asked him what he wanted. He looked nervously in both directions and then asked me if I knew how to play chess. When I told him yes and added that I would enjoy a game, Saint John grinned from ear to ear and mumbled something about being glad that he had taken a chance. I invited him in and we played and talked and drank beer for almost two hours. He was one of nine children from a poor, rural Mississippi family. While we were playing, Saint John casually let slip that he had been a little reluctant to ask me to play because Fish and Miller had told him that niggers were too dumb to play chess.

Saint John and I became friends, at least sort of, for the few more weeks that I stayed there. We were united by the deepest of bonds, we were both outsiders in that strange social structure created by the employees of the Gulfport Inn. It was from Saint John that I learned about the many misconceptions that Southern whites have about blacks.” Troy laughed. “You know, one night Saint John actually followed me to the bath-room to verify with his own eyes that I was not significantly larger than he was.”

Troy returned to his deck chair and looked at Carol. She was smiling. It was hard not to enjoy Troy’s stories. He told them with such enthusiasm and self-involved charm. Under the canopy Nick also had put his book aside and was listening to the conversation.

“Then there was this giant Farrell, early twenties, who looked like Elvis Presley. He supplied liquor to the guests at cut rates, operated an escort

service on call, and took excess hotel goods to sell at his sister's market. He rented part of my room to store some of the liquor. What a character. After big convention breakfasts Farrell would pour the leftover orange juice in the pitchers into bottles and keep it for resale. One morning the hotel manager found a case of the juice temporarily sitting in a room off the lobby and demanded to know what was going on. Farrell grabbed me and took me out front. He told me that he wanted to make a deal. If I would acknowledge that I had taken the juice, Farrell would pay me twenty dollars. He explained that if I confessed, nothing would happen to me, because niggers were expected to steal. But if he Farrell were caught, he would lose his job . . ."

Nick came out from under the canopy. "I hate to break this up," he said, a little sarcastic edge in his voice, "but according to our computer navigator, we are now at the south edge of the region on the map." He handed the map back to Carol.

"Thanks, Professor," Troy laughed, "I believe you saved Carol from being talked to death." He walked over to where all the monitoring equipment had been set up on the footlocker next to the canopy. He turned on the power supply. "Hey, angel, you want to tell me now how this all works?"

Dale Michaels' ocean telescope was programmed to take three virtually simultaneous pictures at each fixed setting. The first of the pictures was a normal visible image, the second was the same field of view photographed at infrared wavelengths, and the third was a composite sonar image of the same frame. The sonar subsystem did not produce crisp pictures, only outlines of objects. However, it probed to greater depths than either the visible or infrared elements of the telescope and could be used even when the water underneath the boat was murky.

Affixed to the bottom of almost any boat, the compact telescope could be driven thirty degrees back and forth about the vertical by a small internal motor. The observation schedule for the telescope was usually defined by a preprogrammed protocol. The details of this sequence as well as the critical optical parameters for the telescope were all stored in the system microprocessor; however, everything in the software could be changed in realtime by manual input if the operator desired.

Data from the telescope was carried to the rest of the electronic equipment on the boat by means of very thin fiber optics. These cables were bracketed along the edge of the boat. About ten percent of the pictures reconstructed from this data were then displayed (after some very crude enhancements) on the boat's monitor in realtime. But all the data taken by the telescope was automatically recorded in the one hundred gigabit memory unit that adjoined the monitor. Another set of fiber optics connected the same memory unit with the boat's central navigation system and the servomotor actuators controlling the telescopes. These circuits were pulsed every ten milliseconds so that the orientation of the telescope and the boat's location at the time of each telescope image could be stored together in the permanent file.

Next to the monitor on top of the footlocker, but on the other side from the memory unit, was the system control panel. Dr. Dale Michaels and MOI were famous throughout the world for the cleverness of their inventions; however, these ingenious creations were not so easy to operate. Dale had tried to give Carol a crash course on the workings of the system the night before she had driven down to Key West from Miami. It had been almost useless. Eventually frustrated, Dale had simply programmed into the microprocessor an easy sequence that mosaicked the area under the boat in regular patterns. He then set the optical gains at normal default values, and instructed Carol not to change anything. "All you have to do," Dr. Michaels had said as he had carefully loaded the system control panel into the station wagon, "is push this GO button. Then cover the panel to make certain that nobody inadvertently hits the wrong command."

So Carol certainly could not explain to Troy how anything worked. She walked over beside him on the boat, put her arm on his shoulder, and grinned sheepishly. “I hate to disappoint you, my inquisitive friend, but I don’t know any more about how this thing works than I told you when we were setting up all the equipment. To operate it, all we have to do is turn on the power supply, which you have already done, and then push this button.” She pushed the GO button on the panel. A picture of the clear ocean about fifty feet underneath the boat appeared immediately on the color monitor. The picture was amazingly sharp. The threesome watched in wonder as a hammerhead shark swam through a school of small gray fish, swallowing hundreds of them in his awesome rush.

“As I understand it,” Carol continued as both men stayed glued in fascination to the monitor, “the telescope system then does the rest, following a planned set of observations stored in its software. Obviously we see what it sees here on this monitor. At least we see the visual image. The simultaneous infrared and sonar pictures are stored on the recorder. My friend at MOI (she didn’t want to alert them even more by using Dale’s name) tried to explain how I could change between the visual and infrared and sonar images, but it wasn’t simple. You’d think it would be as easy as pushing an “I” for infrared or an “S” for sonar. Nope. You have to input as many as a dozen commands just to change which output signal is fed into the monitor.”

Troy was impressed. Not just by the ocean telescope system, but also by the way Carol, a woman admittedly not educated in engineering or electronics, had clearly grasped the essentials of it. “The infrared part of the telescope must measure thermal radiation,” he said slowly, “if I remember my high school physics correctly. But how would underwater thermal variations tell you anything about whales?”

At this point Nick Williams shook his head and turned away from the screen. He recognized that he was hopelessly out of his intellectual element with all these engineering terms and he was more than a little embarrassed to admit his total ignorance in front of Carol and Troy. Nick also didn’t believe for an instant that Carol had brought all this electronic wizardry on board to find whales that had strayed from their migration route. He walked over to the small refrigerator and pulled out another beer. “And what we’re going to do for the next two hours, if I understand it correctly, is ride around in the boat while you look for whales on that screen?”

Nick’s derisive comment carried with it an unmistakable challenge. It intruded upon the warm and friendly rapport that had been created between Carol and Troy. She allowed herself to become irritated again by Nick’s attitude and fired back her own verbal fusillade. “That was the plan, Mister Williams, as I told you when we left Key West. But Troy tells me that you’re something of a treasure hunter. Or at least were some years ago. And since you seem to have convinced yourself that treasure is really what I’m after, perhaps you’d like to sit here next to me and look at the same pictures to make sure I don’t miss any whales. Or treasure, as the case may be.”

Nick and Carol glared at each other for a few moments. Then Troy stepped between them. “Look, Professor . . . and you too, angel . . . I don’t pretend to understand why you two insist on pissing each other off. But it’s a pain in the ass for me. Can’t you just cool it for a while? After all,” Troy added, looking first at Nick and then at Carol, “if you two go for a dive, you’re partners. Your lives may depend on one another. So knock it off.”

Carol shrugged her shoulders and nodded. “Okay by me,” she said. But seeing no immediate response from Nick, she couldn’t resist another shot. “Provided that Mr. Williams recognizes his responsibility as a PADI member and stays sober enough to dive.”

Nick’s eyes flashed angrily. Then he walked over to the deck railing and dramatically poured his new beer into the ocean. “Don’t worry about me,

sweetheart," he said, forcing a smile, "I can take care of myself. You just worry about what you do."

The ocean telescope microprocessor contained a special alarm subroutine that sounded a noise like a telephone ring whenever the programmed alarm conditions were triggered. At Carol's request, Dale Michaels had personally adapted the normal alarming algorithm just before she left for Key West so that it would react to either a large creature moving across the field of view or a stationary "unknown" object of significant size. After he had finished the logic design for the small change and sent it to his software department for top priority coding and testing, Dale had smiled to himself. He was amused by his complicity with Carol. This piece of technological subterfuge would certainly convince Carol's companions, whoever they might be, that she was earnest in her search for whales. At the same time, the alarm would also sound if what Carol was really seeking, supposedly an errant (and secret) Navy missile currently under development, appeared on the ocean floor underneath the boat.

The basic structure for both alarm algorithms was easy to understand. To identify a moving animal, it was sufficient to overlay two or three images taken less than a second apart (at any wavelength, although there was greater accuracy in the process with the sharper visual images), and then compare the data using the knowledge that most of the scene should be unchanged. Significant miscompares (connected areas in the overlay that differed from image to image) would suggest the presence of a large moving creature.

To identify foreign objects in the field of view, the alarm algorithm took advantage of the tremendous storage capacity of the memory unit in the telescope data processing system. The near simultaneous infrared and visual images were fed into the memory unit and then crudely analyzed against a data set that contained chains of pattern recognition parameters over both wavelength regions. These pattern parameters had been developed through years of careful research and had been recently expanded by MOI to include virtually everything normal (plants, animals, reef structures, etc.) that might be seen on the ocean floor around the Florida Keys. Any large object that didn't correlate in realtime with this existing data base would be flagged and the alarm would sound.

The alarms made it unnecessary to sit patiently in front of the screen and study the thousands of frames of data as they were received on the boat. Even Troy, a confessed "knowledge junkie" whose interest in everything was almost insatiable, grew tired of staring at the monitor after about ten minutes, particularly when the boat entered into deeper water and very little could be seen in the visual images.

A couple of solitary sharks triggered alarms and created momentary excitement about twenty minutes after the telescope was activated, but a long period void of any discoveries followed. As the afternoon waned Nick became more and more impatient. "I don't know why I allowed myself to be talked into this wild goose chase," he grumbled to nobody in particular. "We could have been preparing the boat for the weekend charter."

Carol ignored Nick's comment and studied the map one more time. They had traversed from south to north the region she and Dale had defined and were now moving slowly east along the northern periphery. Dale had constructed the search area based upon his own inferences from the questions asked him by the Navy. He probably could have pinned down the area of interest with greater certainty with a few more questions of his own, but he hadn't wanted to arouse any suspicions.

Carol knew that the search was a little like finding a needle in a haystack, but she had thought it would he worthwhile because of the potential payoff. If she could somehow find and photograph a secret Navy missile that had crashed near a populated area . . . What a scoop that would be! But now she too was growing a little impatient and it was hard for her to revive her earlier

excitement after the long afternoon in the sun. They would have to head back to Key West soon to ensure arrival by nightfall. Oh well, she thought to herself with resignation, at least I gave it a shot. And as my father used to say, nothing ventured, nothing gained.

She was standing all the way at the prow of the boat when suddenly alarms started coming from the memory unit next to the monitor. One ring, then two, followed by a brief silence. A third ring then sounded and was rapidly joined by a fourth. Carol rushed excitedly toward the monitor. "Stop the boat," she shouted imperiously at Nick. But she was too late. By the time she reached the monitor, the alarms had stopped and she could not see anything on the screen

"Turn around, turn around," a frustrated Carol hollered immediately, not noticing that Nick was again glaring at her.

"Aye, aye, Cap-i-tan," Nick said, jerking on the wheel with such force that Carol lost her balance. The monitor and other electronic equipment started to slide off their flimsy mountings on the top of the footlocker; they were rescued at the last minute by Troy. The Florida Queen veered sharply in the water. Despite the quietness of the ocean, a small wave came over the railing on the low side of the deck, catching Carol from the knees down. The bottom of her cotton slacks were left clinging to her calves. Her white tennis shoes and socks were drenched. Nick made no effort to hide his amusement.

Carol was about to joust with him again when the renewed ringing of the alarms diverted her attention. Regaining her squishy footing as the boat leveled off, she saw in the monitor that they were above a coral reef. And deep beneath the boat, barely discernible on the screen, were three whales of the same kind that she had seen on the beach that morning at Deer Key. They were swimming together in what appeared to be an aimless pattern. But there was more. The special alarm message code indicated that there was also a foreign object in or near to the same field of view as the desultory whales. Carol could not contain her excitement. She clapped her hands. "Anchor, please," she shouted, and then she laughed. She saw that Troy had already thrown the anchor overboard.

A few minutes later Carol was hurriedly putting on her buoyancy vest in the aft portion of the boat behind the canopy. Her mask and her flippers had already been adjusted and were beside her on the deck. Troy was helping her by holding up the air bottle that was built into the back of the bulky vest. "Don't worry about Nick," Troy said. "He may be grumpy today for some reason, maybe because Harvard lost the basketball game, but he's a fabulous diver. And he has the reputation of being the best dive teacher in the Keys." He grinned. "After all, he taught me a couple of months ago and we're not even supposed to be able to swim."

Carol smiled and shook her head at Troy. "Don't you ever stop joking?" she said. She slid her free arm through the second opening and the vest fell into place. "By the way," she continued softly, "for an expert diver your friend certainly uses antiquated equipment." At this moment she regretted her decision to leave her customized diving vest in the station wagon. She always used it when she dove with Dale and it had all the latest advances, such as ABC (Automatic Buoyancy Compensation) and a perfect pocket for her underwater camera. But after all the brouhaha when she came through the marina headquarters with her footlocker of electronic equipment, Carol had decided not to attract further attention by bringing in a state-of-the-art diving vest.

"Nick thinks the new vests make it too easy for the diver. He wants them to have to adjust their buoyancy manually — so that they are more conscious of how far down they are." Troy looked Carol over. "You're pretty light. This belt may be enough by itself. Do you normally use any weights?"

Carol shook her head and pulled the belt around her waist. Nick came around the canopy carrying his mask and flippers. He had already put on his

diving vest with air bottle and his weighted belt. “Those whales of yours are still in the same spot down there,” he said. “I’ve never seen whales hang around like that. “He handed her a piece of chewing tobacco. She rubbed the tobacco on the inside of her mask (to prevent fogging) while Nick walked around behind her. He looked at her air gauge and checked both her regulator and the secondary mouthpiece that he might have to use to share her air in the event of an emergency.

Nick talked to Carol while he was making her final equipment checks. “This is your charter,” he began in what sounded like a friendly tone, “so we can go almost anywhere you want while we are down there. The dive will not be too difficult, since it’s only forty-five feet or so to the floor. However,” Nick moved around in front of Carol and looked directly in her eyes, “I want one thing thoroughly understood. This is my boat and I am responsible for the safety of the people on it. Including you, whether you like it or not. Before we dive, I want to make certain that you will follow my lead under the water.”

Carol recognized that Nick was trying to be diplomatic. It even flashed through her mind that he looked sort of cute standing there in front of her in his diving gear. She decided to be gracious. “Agreed,” she said. “But one thing before we descend. Remember that I’m a reporter. I will have a camera with me and may want you to move from time to time. So don’t get angry if I motion you out of the way.”

Nick smiled. “Okay,” he said, “I’ll try to remember.”

Carol put on her flippers and mask. Then she picked up her underwater camera by the strap and threw it over her neck and shoulder. Troy helped her tighten the strap in the back. Nick was sitting on the side of the boat at a break in the railing, right next to a crude ladder that Troy had just dropped overboard. “I’ve checked the water already,” Nick said, “and there’s quite a current up here. Let’s go down the anchor rope until we reach the ocean floor. Then you can pick the direction from there.”

Nick rolled backward off the boat. In a moment he surfaced, treading water. Carol returned his thumbs-up sign (the signal between divers that everything’s all right) and sat down herself on the side of the boat. Troy helped her make one last comfort adjustment to her vest. “Good luck, angel,” Troy said. “I hope you find what you’re looking for. And be careful.”

Carol put the regulator in her mouth, took a breath, and then repeated Nick’s backward roll maneuver. The ocean water felt cool against her sunbaked back. In a few seconds she joined Nick over at the anchor rope and the two of them repeated the thumbs up sign. Nick led the way down. He went hand over hand, cautiously, never completely releasing the rope. Carol followed carefully. She could feel the strong current that Nick had mentioned. It pulled at her, trying to take her away from the rope, but she managed to hold on. Every six to eight feet in the descent, Nick stopped to equalize the pressure in his ears and looked up to see both that Carol was following and that she was all right. Then he continued his descent.

There was nothing much to see until they reached the reef beneath them. The telescope pictures had been so sharp that they had been misleading. The reef with its riot of color and its surfeit of plant and animal life had seemed to be right underneath them because of the automatic focusing action of the optical system. But thirty-five feet is a long way down. Any normal three-story building could have been sitting on the ocean floor underneath the Florida Queen and it would not have touched her hull.

When they finally reached the top of the reef where the anchor was implanted, Carol realized she had made a mistake. She did not recognize her surroundings and therefore did not know which direction to take to find the whales. She reproached herself briefly for not having spent a few more moments studying the monitor to make sure that she knew where all the landmarks were. Oh well, Carol then thought, It’s too late for that now. I’ll just pick a

direction and go. Besides, I don't have any idea where the alarm object is anyway.

Visibility in the water was fair to good, maybe fifty to sixty feet in all directions. Carol adjusted her buoyancy slightly and then pointed to a gap between two reef structures, both of which were covered with kelp, sea anemones, and the ubiquitous coral. Nick nodded his head. Tucking her arms to her side to streamline her movement, Carol kicked up and down with her flippers and swam toward the gap.

Behind her, Nick watched Carol swim with appreciation and admiration. She moved through the water as gracefully as the school of yellow and black angelfish beside her. Nick had not interrogated Carol very much about her diving experience and had not known exactly what to expect. He had suspected from her ease and familiarity with the equipment that she was a seasoned diver; but he had not prepared himself for an underwater peer. Except for Greta, Nick had not encountered a woman before who was as comfortable under the water as he was.

Nick absolutely loved the peace and serenity of the rich and vibrant world beneath the ocean surface. The only sound he ever heard down there was his own breathing. All around him the coral reefs teemed with life of unimaginable beauty and complexity. There, underneath him now, was a grouper taking a bath by sitting at the bottom of a natural hole and letting dozens of tiny cleaner fish eat away all the accumulated parasites. A moment earlier, Nick's downward excursion toward the ocean floor had scared up a manta ray hidden in the sand. This large ray, called a devilfish by the cognoscenti, had undulated out of its hiding place at the last moment and just missed Nick with its powerful and dangerous tail.

Nick Williams felt at home down in this watery world at the bottom of the Gulf of Mexico. It was his recreation and his refuge. Whenever he was distressed or disturbed by events on the surface, he knew that he could dive and find relaxation and escape. Except on this particular dive he was aware of an ineffable emotion, a beginning perhaps, a longing that was barely defined, possibly mixed up with a memory of years ago. He was following a beautiful mermaid as she swam along the reef and the sight stirred him. I have acted like a schoolboy, he thought, and a bore. Or worse. And why? Because she is pretty? No. Because she is so alive. So much more alive than I am

Carol and Nick made two different excursions, each time starting from the anchor rope, without finding the whales or anything else unusual. When they returned to the anchor after the second unsuccessful foray, Nick pointed at his watch. They had been under the water for almost half an hour already. Carol wagged her head up and down and then held up her index finger, indicating that she would try one more direction.

They found the whales right after they crossed over a big upward bulge in the reef that came within fifteen feet of the surface. Nick saw them first and pointed down. The three whales were about twenty feet below them and maybe thirty yards ahead. They were still swimming slowly, more or less together, in the same directionless, near circular pattern that Nick and Carol had watched on the screen. Carol waved Nick out of the way and pointed at her camera. She then swam toward the whales, taking pictures as she approached them while carefully monitoring her depth and equalizing the pressure in her ears.

Nick swam down beside her. He was certain the whales had seen the two of them, but for some reason they had made no attempt to flee. In all his years as a diver, Nick had only once seen a whale in the open ocean accept the nearby presence of a human. And that had been a calfing mother, in a Pacific Ocean lagoon off of Baja California, whose birth pangs were a more powerful force than her instinctive fear of humans. Here even when Carol approached to within

twenty feet or so the whales continued their indolent drift. They appeared to be lost, or maybe even drugged.

Carol slowed her approach when the whales made no attempt to get away. She took some more photographs. Close-up pictures of whales in their natural habitat were still uncommon, so her trip had already been a journalistic success. But she too was puzzled by their behavior. Why were they ignoring her presence? And what were they doing hanging around this particular spot? She remembered being surprised by the solitary whale during her morning swim and wondered again if somehow all these strange events were related.

Nick was off to her right, about twenty yards away. He was pointing at something on the other side of the whales and gesturing for Carol to come toward him. She swam away from the great mammals and headed in Nick's direction. She saw immediately what had attracted his attention. Below the whales, just above the ocean floor, there was a large dark hole in the bottom of an imposing reef structure. At first glance it appeared to be the entrance to an underground cave of some kind. But Carol's sharp eyes noticed that the lip-shaped fissure was extremely smooth and symmetric, almost suggesting to her that it was an engineering construction of some kind. She laughed at herself as she swam up beside Nick. The amazing underwater world and the bizarre behavior of these whales were playing tricks with her mind.

Nick pointed down at the hole and then at himself, indicating that he was going down to check it out more closely. When he started to leave, Carol had a sudden impulse to reach for his foot and pull him back. A moment later, as she watched Nick swim away, a powerful fear of unknown origin swept over her. She began to tremble as she struggled gamely with this strange emotion. Goose bumps appeared on her arms and legs and Carol felt an overwhelming desire to get away, to escape before something terrible happened.

An instant later she saw one of the whales move toward Nick. If Carol had been on land she could have yelled, but fifty feet deep in the ocean there was no way to warn someone from afar. As Nick drew near the opening, unaware of any danger, he was brushed to the side by one of the whales with such force that he bounced against the reef and then caromed off. He fell down onto a small spot of sand on the ocean floor. Carol swam toward him quickly while keeping a careful eye on the whales. Nick had lost his regulator and did not seem to be making any attempt to replace it. She drew up beside him and flashed the thumbs-up sign. There was no response. Nick's eyes were closed.

Carol felt a surge of adrenaline as she reached for Nick's regulator and thrust it into his mouth. She beat against his mask with her fist. After a few painfully long seconds, Nick opened his eyes. Carol tried thumbs up again. Nick shook his head, as if he were clearing out the cobwebs, smiled, and then returned the okay signal. He started to move but Carol restrained him. She indicated with gestures for him to sit still while she hurriedly looked him over. From the force with which Nick had hit the reef, Carol feared the worst. Even if his diving gear was all right, certainly his skin would have been ripped and torn by the sharp coral and the impact. But incredibly, there did not appear to be significant damage to either Nick or the equipment. All she could find were a couple of small scrapes.

The three whales remained in the same area where they had been before. Looking up at them from below, Carol thought that they looked like sentinels guarding a particular piece of ocean territory. Back and forth they swam, inscribing a total composite arc of maybe two hundred yards. Whatever it had been that had caused one of the whales to vary its swimming pattern and run into Nick was certainly unclear. But Carol did not want to risk another encounter. She motioned for Nick to follow her and they swam about thirty yards away, to a sandy trench between the reefs.

Carol planned to return to the surface as soon as it was clear that Nick was not seriously hurt. But while Carol was thoroughly surveying his body to

make certain that she had not overlooked any serious lacerations in her hurried check, Nick discovered two parallel indentations in the sand below him. He grabbed Carol's arm to show her what he had found. The indentations were grooved like tank tracks and were about three inches deep. They appeared to be fresh. In one direction the tracks ran toward the reef fissure underneath the three whales. In the other direction the parallel lines extended as far as Nick and Carol could see, running along the sandy trench between the two major reefs in the area.

Nick pointed up the trench and then swam away in that direction, following the tracks with fascination. He did not turn around to see if Carol were following. Carol quickly backtracked as close to the fissure as she dared (was she imagining again or were the three whales watching her as she crept along the ocean floor?) to take some pictures and to verify that the tracks did indeed emanate from the opening in the reef. She thought she saw a network of similar indentations converging just in front of the fissure, but she did not tarry long. She didn't want to be separated from Nick in this spooky place. When she turned around, he was just barely in sight. But he had fortunately stopped when he realized that Carol was not behind him. Nick made an apologetic gesture when she finally caught up with him.

At one point the parallel lines disappeared as the sandy trench turned to rock, but Nick and Carol located the continuation of the same tracks some fifty yards farther along. The trench eventually became so narrow that they were forced to swim six feet or so above it to keep from banging against the rocks and coral on either side. Soon thereafter the tracks and the trench made a left turn and disappeared under an overhang. Carol and Nick stopped and floated in the water facing each other. They carried on a conversation with hand gestures. At length, they decided that Carol would go down first to see if anything was under the overhang, since she wanted a close-up photograph of the disappearance of the tracks anyway.

Carol swam carefully down to the floor of the trench, skillfully avoiding contact with the edges of the reef on both sides. Where it disappeared under the overhang, the trench was just wide enough for her to put one of her flippered feet down lengthwise. The overhang was about eighteen inches above the floor, but there was no way she could bend down and look underneath without scraping her face or hands against the reef. Carol gingerly slid her hand under the overhang in the last direction of the tracks. Nothing. She would have to brace herself against the rocks and coral and stick her hand deeper into the area.

While Carol was trying to move herself into a better position, she momentarily lost her balance and felt the sting of coral on the back of her left thigh. Ouch, she thought as she put her right hand back under the overhang, that's one for me. One physical reminder of an amazing day. Weird even. Bizarre whales. Tank tracks on the bottom of the ocean . . . what is this? Carol's hand closed around what felt like a metallic rod about an inch thick. It was such a surprising touch, she immediately withdrew her hand and a shudder raced down her spine. Her heart rate accelerated and she tried to breathe slowly to calm herself. Then she purposefully put her hand back and found the object again. Or was it another object? This time she felt something metallic all right, but it seemed to be wider and to have four tines like a fork. Carol slid her hand along the object and refound the rod portion.

From his vantage point above her, Nick could tell that Carol had discovered something. Now it was his turn to be excited. He swam down to her as she struggled unsuccessfully to retrieve the object. They changed positions and Nick reached under the projecting rock. He first touched something that felt like a smooth sphere about the size of the palm of his hand. Nick could tell that the bottom of the sphere rested on the sand and that the rod attached to it was elevated by several inches. Nick steadied himself and jerked on the

rod. It moved a little. He moved his grip sideways on the rod and heaved again. Several more pulls and the object was out from under the overhang.

For almost a minute Nick and Carol hovered over the gold-metallic object lying beneath them on the sand. Its surface was smooth to the eye as well as to the touch and altogether it was about eighteen inches long. Nothing but the polished, reflecting surface could be seen, suggesting that the object was indeed made from some kind of metal. The long axis of the object was an inch-thick rod that was, at one end, tapered and worked into a kind of a hook. Four inches back from the hook was the center of a small sphere, symmetrically constructed around the rod, whose radius was a little over two inches. The larger sphere that Nick had felt when he first put his hand under the overhang had a radius of four inches or so and it was right in the middle of the rod. This sphere was also perfectly symmetric around the rod axis. Beyond the two spheres the object was unadorned until the rod broke into four smaller branches, the tines that Carol had felt, at its other end.

Carol carefully took photographs of the object as it lay exposed in front of the overhang. Before she was finished, Nick pointed at his watch. They had been underwater almost an hour. Carol checked her air gauge and found that she was almost into the red. She waved a sign at Nick and he swam down to pick up the object. It was extremely heavy, weighing an astonishing twenty pounds or so in Nick's estimation. Then it wasn't caught on anything when I was trying to pull it out, Nick thought, it's just that heavy.

The weight of the object only increased Nick's excitement that had begun when he had first seen the gold color. Although he had never seen anything quite like this hook and fork with spheres, he remembered that the heaviest pieces from the wreck of the Santa Rosa had all been made of gold. And this piece was far heavier than anything he had ever touched. Jesus, he thought to himself as he discarded some of the lead weights in his belt to make it easier for him to carry the object up to the boat, if there's even ten pounds of pure gold here, at current market value of a thousand dollars an ounce, that's $160,000, and this may just be the beginning. Wherever this thing came from, there must be more. All right, Williams. This may be your lucky day.

Carol's thoughts raced at a mile a minute as she swam in tandem with Nick toward the anchor rope. She was busy trying to integrate everything she had seen in the last hour. She was already convinced that everything was somehow associated with the errant Navy missile — the behavior of the whales, the golden fork with the hook, the tank tracks on the bottom of the ocean. But at first Carol had no clue about what the connections were.

During the swim back Carol suddenly remembered reading some years before a story about Russian submarine tracks being found on the ocean floor outside a Swedish naval yard. In her journalistic mind she began to concoct a wild but plausible scenario to explain everything that she had seen. Maybe the missile crashed near here and continued to send out data even when it was underwater, she thought to herself. Its electronic signals somehow confused the whales. And maybe those same signals were picked up by Russian submarines. And American. Her thoughts came to a temporary dead end for a moment. So there are at least two choices, Carol thought again after swimming a few more strokes and watching Nick approach the anchor rope with the golden object still firmly in his hand. Either I've found a Russian plot to locate and steal an American missile. Or the tracks and goldenfork are somehow part of an American effort to find the missile without alerting the public. It doesn't matter. Either way it's a big story. But I must take that golden thing to Dale and MOI to analyze.

Both Nick and Carol were dangerously low on air by the time they reached the surface beside the Florida Queen. They called Troy to give them a hand with their prize from the deep. Carol and Nick were exhausted when they finally crawled into the boat. But they were also both on emotional highs, thrilled with the discoveries of the afternoon. Everyone started talking at once. Troy

had a story to tell too, for he had seen something unusual on the monitor while Nick and Carol were following the tracks in the trench. Nick pulled some beer and sandwiches out of the refrigerator and Carol tended her coral cuts. The laughing trio sat down on the deck chairs together as the sun was setting. They had much to share during the ninety-minute trip back to Key West.

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THE camaraderie lasted most of the way back to the marina. Nick was no longer taciturn. Excited by what he believed was the initial find of a major sunken treasure, he was positively a chatterbox. At least twice he retold his version of the whale encounter. Nick was certain that the collision was accidental, that the whale simply happened to be moving in that direction for some other reason and just paid no attention to the fact that Nick was there.

"Impossible," Nick had scoffed when Carol had initially suggested that the whale might have deliberately hit him because he was heading for the fissure in the reef. "Whoever heard of whales guarding a spot in the ocean. Besides, if your theory's right, then why didn't the whale really smack me, and finish me off? You're asking me to accept that the whales were protecting an underground cave? And then that they were warning me to stay away with that gentle push?" He laughed good-naturedly. "Let me ask you something, Miss Dawson," he said, "do you believe in elves and fairies?"

"From where I was watching," Carol replied, "it sure looked as if the whole thing was planned. "She did not pursue the subject further. In fact, after her initial outbursts, Carol did not talk very much about anything on the trip back to Key West. She too was excited and she was worried that if she talked too much she might inadvertently give away her thoughts about the possible connection between what they had seen and the lost Navy missile. So she didn't mention either her eerie fear just before the whale hit Nick or the network of tracks she thought she saw converging just under the base of the fissure.

As far as Nick was concerned, the object they had retrieved was definitely part of a treasure. It didn't bother him that it was hidden under an overhang at the end of some strange tracks. He shrugged it off by suggesting that maybe somebody had found the sunken treasure several years earlier and then tried to hide a few of the better pieces. (But why were the tracks fresh? And what had made them? Carol wanted to ask these questions but realized it was in her best interest for Nick to remain convinced that he had found treasure.) Nick was blind to all arguments and even facts that didn't support his treasure theory. It was emotionally vital to Nick for the gold fork thing to be the first piece of a great discovery. And like many people, Nick was capable of suspending his normally sharp critical faculties when he had a vested emotional involvement in an issue.

When Nick and Carol finally quieted down enough to listen, Troy had a chance to tell his own story. "After you guys left the area underneath the boat, I guess to follow your trench, I became worried about you and started watching the screen more often. Now, angel, by this time those three whales had been swimming about in that same dumb pattern for over an hour. So I wasn't checking them real close."

Troy was up out of his deck chair, walking back and forth in front of Carol and Nick. It was a dark night; low clouds had rolled in from the north to block the moon and obscure most of the stars. The spotlight from the top of the canopy occasionally caught Troy's chiseled features as he moved in and out of the shadows. "Because I wanted to find you guys, I lifted the alarm suppression the way you showed me and was regularly serenaded by the ding-dong-ding from the three whales. Now listen to this. After a couple of minutes, I heard a fourth

alarm. I looked down at the monitor, expecting to see one of you, and I saw another whale, same species, swimming underneath the other three and in the opposite direction. Within ten seconds the original whales turned, breaking their long pattern, and followed the new whale off the monitor to the left. They never returned."

Troy wound up the story with a dramatic inflection and Nick laughed out loud, "Jesus, Jefferson, you do have a way of telling a story. I suppose you're going to tell me now that these whales were stationed there and the new guy came along with different orders. Or something like that. Christ, between you and Carol, you'll have me believe that the whales are organized into covens of whatever." Nick stopped for a moment. Troy was disappointed that Carol didn't say anything.

"Now," Nick continued, dismissing Troy's story and getting to the subject he had been thinking about for almost an hour, "we have an important issue to discuss. We have brought back something from the ocean that could conceivably be worth a lot of money. If nobody else can prove conclusively that it is theirs, then it will belong to the finders." Nick looked first at Carol and then at Troy. "Even though I'm captain and owner of this boat and I carried the thing up from the ocean floor, I'm prepared to offer that we split the proceeds in thirds. Does that sound fair enough to the two of you?"

There was a moderately long silence before Troy answered. "Sure, Nick, that sounds fine to me." Nick smiled and reached across to shake Troy's hand. He then extended his hand to Carol.

"Just a minute," she said quietly, looking directly at Nick and not taking his hand. "Since you've decided to start this conversation, there are several more items that must be discussed. It's not simply a question of money for this object. There's also the issue of possession. Who keeps the golden trident? Who determines when we've been offered a fair price? What do we agree to say, or not to say, to others? And what if other objects are found down there by one or more of us? Do we all share? There's an entire agreement that must be worked out before we dock."

Nick frowned. "Now I understand why you've been so quiet these last few minutes. You've been thinking about your share. I misjudged you. I thought you might decide not to create any more trouble — "

"Who said anything about trouble?" Carol interrupted him abruptly, her voice rising slightly. "If you must know, I'm not that interested in the damn money. I will gladly take my one-third if any dollars are forthcoming from the trident there, for I certainly deserve it. But if any more such treasures are down there and you and Troy can find them without me, then be my guest. I want something else."

Both men were now listening intently. "First and foremost, I want exclusive rights to this story, and that means absolute secrecy about what we have found, when and where we found it, and anything else associated with it — at least until we're certain there's nothing more to learn. Second, I want immediate possession of the object for forty-eight hours, before anyone else knows that it exists. After that you can have it to take to the authorities for evaluation."

Uh oh, Carol thought to herself as she saw the searching looks she had elicited from Nick and Troy. I overdid it. They suspect something. Better back off just a bit. "Of course," she smiled disarmingly, "I've just given my initial position. I expect that some negotiations may be necessary."

"Wow, angel," Troy said with a laugh, "that was some speech. For just a minute there, I thought that maybe there was a whole other game going on here and you were the only one playing. Of course the professor and I will be delighted to discuss an agreement with you, won't we, Nick?"

Nick nodded. But he had also been alerted by the careful organization and unmistakable intensity of Carol's response. It seemed out of proportion to the

journalistic value of their find. Is she trying to make this some kind of a contest between us? he thought to himself. Or am I missing something altogether?

They had worked out a compromise agreement by the time the Florida Queen reached the dock in Key West. Nick would take the golden trident (both of the men liked Carol's name for the object) with him on Friday morning. There was an elderly woman in Key West who was a compendium of treasure knowledge and she would be able to assess its value and to give its probable place and date of origin. The woman would also be a witness to their find in case the trident were ever misplaced. On Friday afternoon, the three of them would meet on the boat or in the marina parking lot at four o'clock. Nick would give the object to Carol and she would keep it over the weekend. After she returned it to Nick on Monday morning, he would be responsible for its care and eventual sale. The three of them had joint ownership of the trident, but Carol waived any interest in future discoveries. Carol wrote the terms of the simple agreement on the back of a restaurant menu from her purse, they all signed it, and she promised to bring copies back the next day.

Troy was quiet and subdued while he was loading all Carol's equipment back into the footlocker. He lifted the locker onto the cart and then pulled the cart along the jetty. Carol walked beside him. It was about nine o'clock and very quiet at the marina. The tall fluorescent lights created a strange reflection on the wooden jetties. "Well, angel," Troy said as Carol and he approached the marina headquarters, "it's been quite a day. I've really enjoyed your company." He stopped and turned to look at her. Her black hair had dried unevenly and looked a bit disheveled, but her face was beautiful in the reflected light.

Troy looked away, out at the water and the boats. "You know, it's a shame sometimes the way life works. You meet somebody by chance, you strike up a friendship, and then poof, they're gone. It's all so . . . so transient."

Carol came over beside him and stretched to kiss his cheek. "And you know I like you, too," she said, lightening up the conversation with a grin and making certain that Troy understood what kind of a friendship they could have. "But cheer up. All is not lost. You'll see me tomorrow for a while and then maybe when I return the golden thing on Monday."

She hooked her arm through his as they momentarily walked back down the Jetty, away from the loaded cart. "And who knows," Carol laughed, "I'm down in the Keys from time to time. We could have a drink together and you could tell me some more stories. "They could just barely make out the spotlight above the canopy on the Florida Queen some hundred yards in the distance. "I see your friend the professor is still at work. He's not strong on good-byes. Or any other area of manners as far as I can tell."

She turned, switching locked arms, and they walked back to the loaded cart. They moved through the apparently deserted headquarters without speaking. When the footlocker had been replaced in the station wagon, Carol gave Troy a hug. "You're a good man, Troy Jefferson," she said. "I wish you well."

Nick was almost ready to leave by the time Troy returned to the boat. He was packing a small exercise bag. "Looks innocent enough, doesn't it, Troy? Nobody will ever suspect that one of the great treasures of the ocean is in here." He paused a moment and changed the subject. "You put her safely in her car? Good. She's a strange one, isn't she, all feisty and aggressive but still pretty at the same time. I wonder what makes her tick."

Nick zipped up the bag and walked around to the side of the canopy. "Just finish up with the diving gear tonight. Don't worry about the rest of the boat — we'll fix it up tomorrow. I'm going to go home and dream of riches."

“Speaking of riches, Professor,” Troy said with a smile, “how about that hundred-dollar loan I asked you for on Tuesday. You never answered me and just said we’ll see.”

Nick walked deliberately over to Troy and stood right in front of him. He spoke very slowly. “I should have made my Polonius speech to both of us when you asked me for a loan the first time. But here we are now, borrower and lender, and I don’t like it. I will lend you a hundred dollars but, Mister Troy Jefferson, this is positively the last time. Please don’t ever ask me again. These loans for your so-called inventions are making it hard for me to work with you.”

Troy was a little surprised by the unexpected harshness in Nick’s tone. But he was also angered by the connotation of the last sentence. “Are you suggesting,” Troy said softly, suppressing his temper, “that I’m not telling the truth, that the money is not being spent on electronics? Or are you telling that you don’t believe an uneducated black man could possibly invent anything worth having?”

Nick faced Troy again. “Spare me your righteous racial indignation. This is not a question of prejudice or lies. It’s money, pure and simple. My lending you money is fucking up our friendship.” Troy started to speak but Nick waved him off. “Now it’s been a long day. And a fascinating one at that. I’ve said all I want to say on the subject of the loan and I consider the issue finished.”

Nick picked up his bag, said good night, and left the Florida Queen. Troy went behind the canopy to organize the diving gear. About ten minutes later, just as he was finishing, he heard someone calling his name. “Troy . . . Troy, is that you?” an accented voice said.

Troy leaned around the canopy and saw Greta standing on the jetty under the fluorescent light. Even though there was now a slight chill in the air, she was wearing her usual skimpy bikini that showed off her marvelous physique. Troy broke into a grand smile, “Well, well, if it isn’t superkraut! How the hell are you? I can see you’re still taking care of that wondrous body.”

Greta managed the beginnings of a smile. “Homer and Ellen and I are having a small party tonight. We noticed that you were working late and thought that maybe you’d like to join us when you’re done.”

“Just might do that,” Troy said, nodding his head up and down. “Just might do that.”

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“OH, God, can’t we stop now? Finally? Please let us. It’s so quiet here, now.” She was speaking to the stars and the sky. The old man’s head slumped forward in the wheelchair as he drew his last breath. Hannah Jelkes knelt beside him to see if he was indeed gone and then, after kissing him on the crown of the head, she looked up again with a peaceful smile. The curtain fell and rose again in a few seconds. The cast assembled quickly on stage.

“Okay, that’s it for tonight, good job.” The director, a man in his early sixties, gray hair thinning on the top, approached the stage with a bounce. “Great performance, Henrietta, try to can that one for the opening tomorrow night. Just the right combination of strength and vulnerability.” Melvin Burton nimbly jumped up on the stage. “And you, Jessie, if you make Maxine any lustier they’ll close us down.” He spun around with a flourish and laughed along with two other people at the front of the theater.

“Okay, gang,” Melvin turned back to address the cast, “now go home and get lots of rest. It was better tonight, looked good Oh, Commander, can you and Tiffani stay around for a moment after you change? I have a couple more pointers for you.”

He jumped back down from the stage and walked back to the fourth row of the theater where his two associates were sitting. One was a woman, even older than Melvin but with twinkling green eyes behind her granny glasses. She was wearing a bright print dress full of spring colors. The other person was a man, about forty, with a studious face and a warm, open manner. Melvin fretted as he sat down beside them. "I worried when we picked Night of the Iquana that it might be too difficult for Key West. It's not as well known as Streetcar or Glass Menagerie. And in some ways the characters are just as foreign as those in Suddenly, Last Summer. But it looks almost okay. If we can just fix the scenes between Shannon and Charlotte."

"Are you sorry now you added the prologue?" the woman asked. Amanda Winchester was an institution in Key West. Among other things, she was the doyenne of the theatrical entrepreneurs in the revitalized city. She owned two of the new theaters near the marina and had been responsible for the formation of at least three different local repertory groups. She loved plays and theater people. And Melvin Burton was her favorite director.

"No, I'm not, Amanda. It clearly adds to the play to get some kind of initial feeling for how frustrating it would be to lead a group of Baptist women on a tour of Mexico in the summer. And without the sex scene between Charlotte and Shannon in that small, stuffy hotel room, I'm not sure their affair is believable to the audience." He paused a moment, reflecting. "Huston did the same thing with the movie."

"Right now that sex scene doesn't play at all," the other man said. "In fact it's almost comical. The hugs they exchange are like the ones my brother gives his daughters."

"Patience, Marc," Melvin answered.

"Something has to be done or we should take the prologue out altogether," Amanda agreed. "Marc's right, the scene tonight was almost comical. Part of the problem is that Charlotte looks like a child in that scene." She paused a moment before continuing. "You know, the girl has gorgeous long hair and we have it stacked on top of her head to look prim and proper. Clearly she wouldn't wear it down all day in the heat of a Mexican summer. But what if she took it down when she went to Shannon's room?"

"That's a great idea, Amanda. As I have often said, you would have made a fabulous director." Melvin looked at Marc and they exchanged a warm smile. Then the director settled back in his seat and started thinking about what he was going to tell his two cast members in a few moments.

Melvin Burton was a happy man. He lived with his room-mate of fifteen years, Marc Adler, in a beach house on Sugarloaf Key, about ten miles east of Key West. Melvin had directed plays on Broadway for almost a decade and had been associated with the theater in one capacity or another since the mid-fifties. Always careful with his money, Melvin had managed to save an impressive amount by 1979. Worried about the impact of inflation on his savings, Melvin had sought advice from an accountant who was a friend of a close associate. It was almost love at first sight. Marc was twenty-eight at the time, shy, lonely, unsure of himself in the maelstrom of New York City. Melvin's savoir faire and theatrical panache opened Marc up to aspects of life that he had never known.

As the stock market ratcheted upward in the mid-eighties, Melvin watched his net worth near a million dollars. But other factors in his life were not so bullish. The AIDS epidemic hit the theatrical community in New York with a vengeance and both Melvin and Marc lost many of their lifelong friends. And Melvin's career seemed to have peaked; he was no longer in demand as one of the premier directors.

One night on his way home from the theater, Marc was mugged by a group of teenagers. They beat him up, stole his watch and wallet, and left him bleeding in the street. As a saddened Melvin ministered to his friend's wounds, he made

a major decision. They would leave New York. He would sell his stocks and convert his fortune to fixed income investments. They would buy a home where it was warm and safe, where they could relax and read and swim together. Maybe they would do some community theater work if it was available, but that was not the most important thing. What was important was that they share Melvin's remaining years.

Melvin ran into Amanda Winchester one day while he and Marc were on vacation in Key West. They had worked together briefly on a project that had never panned out twenty years before. Amanda told him that she had just formed a local amateur repettory group to do two Tennessee Williams plays a year. Would he be interested in directing them?

Melvin and Marc moved to Key West and started to build their house on Sugarloaf Key. Both of them thoroughly enjoyed their work with the Key West Players. The actors were everyday people, dedicated and earnest. Some had had a little acting experience. But for the most part, the secretaries, housewives, and retail clerks, plus officers and enlisted men from the U.S. Naval Air Station, were all novices with one thing in common. Each of them viewed his few days on the stage as his moment of glory, and he wanted to make the best of it.

Commander Winters came out of the dressing room first. He was wearing his uniform (he had come right over to rehearsal from the base) and looked a bit stiff and uncertain. He sat down in one of the theater chairs next to Amanda Winchester. "I was really glad to see you back again," said Amanda, taking his hand. "I thought your Goober last fall was just right."

Winters thanked her politely. Amanda changed the subject. "So how are things out at the base? I read an article the other day in the Miami Herald about all the modern weapons the Navy has these days, pilotless submarines and vertical takeoff fighters and search and destroy torpedoes. There seems to be no limit to our ability to build more powerful and dangerous toys for war. Are you involved with all that?"

"Only in a limited way," Commander Winters answered pleasantly. Then, anticipating the discussion with the director, he leaned forward so that he could see Melvin and Marc as well as Amanda. "I apologize if I was a little flat tonight," he began. "We have a couple of big problems out at the base and I may have been a bit distracted, but I'll be ready tomorrow — "

"Oh, no," said Melvin, interrupting him, "that's not what I wanted to talk to you about. It's your first scene with Tiffani . . . Ah, here she comes. Let's go up on the stage."

Tiffani Thomas was almost seventeen years old and a junior at Key West High School. A Navy brat all her life, Tiffani had gone to seven different schools in her eleven years since kindergarten. Her father was a noncommissioned officer who had been assigned to Key West about three months before. She had been recommended to Melvin Burton by the high school drama teacher when it became apparent that Denise Wright simply could not play the role of Charlotte Goodall.

"She hasn't done anything for me yet except rehearse," the teacher had said of Tiffani, "but she learns her lines quickly and has a quality, an intensity I guess, that sets her apart from the others. And she's clearly been in plays before. I don't know if she can get ready in three weeks, but she's my first choice by far."

Tiffani probably would not have been called beautiful by her Florida classmates. Her features were too much out of the ordinary to be be properly appreciated by most high school boys. Her assets were olive eyes, quiet and brooding, light freckles on a pale complexion, long red eyelashes tinged with brown, and a magnificent head of thick auburn hair. Her carriage was proper and erect, not slumped like most teenagers, so she probably seemed aloof to her peers. "Striking," Amanda called her, accurately, when she first saw Tiffani.

She was standing on the stage alone in her short-sleeved blouse and jeans as the two men approached. Her hair was pulled back in a ponytail the way her father liked it. Tiffani was very nervous. She was worried about what Mr. Burton was going to say to her. She had overheard the buyer who was playing Hannah Jelkes say that Melvin might do away with the part of Charlotte altogether if "the new girl can't hack it. "I have worked so hard for this part, Tiffani thought. Oh please, please, don't let it be bad news.

Tiffani was looking down at her feet when Melvin Burton and Commander Winters joined her on the stage. "Well, now," Melvin began, "let's get straight to the point. The first scene with you two in the hotel room is not working. In fact, it's a disaster. We must make some changes."

Melvin saw that Tiffani was not looking at him. Gently he put his hand under her chin and lifted it until her eyes met his. "You must look at me, child, for I'm trying to tell you some very important things." He noticed that her eyes were brimming with water and his years of experience told him immediately what was wrong. He leaned forward and whispered so that nobody else could hear, "I said we would make some changes, not do away with the scene. Now get yourself together and listen up."

Burton regained his director's voice and turned toward Winters. "In this scene, Commander, your character Shannon and young Miss Goodall engage in foreplay that leads to intercourse later that night. In the following scene they are discovered, in flagrante delicto, by the confused Miss Fellowes. And that establishes the desperate situation causing Shannon to run to Maxine and Fred at the Costa Verde.

"But our scene does not work right now because nobody watching it will recognize what you two are doing as foreplay. Now I can change the movement to make it easier — putting Shannan already on the bed when he discovers Charlotte behind the door would be one way — and I can change Charlotte's clothing so that she looks less like a little girl, but there's one thing that I cannot do . . ." Melvin stopped and looked back and forth from Tiffani to Winters. They were both staring blankly at him.

"Come here, come here, both of you," Melvin said, gesturing impatiently with his right hand. He dropped his voice again. He took Tiffani's hand with his left and Commander Winters' with his right. "You two are lovers for one night in this play. It is essential that the audience believe this or they will not understand completely why Shannon is at the end of his rope, like the iguana. Shannon is desperate because he was originally locked out of his church for giving in to the same lust . . ."

They were both listening but Melvin's director's intuition told him he was still not reaching them. He had another idea. He took Tiffani's hand and put it into the commander's, closing his own hand over theirs for emphasis. "Look at each other for a moment. That's right." He turned to Winters. "She's a beautiful young woman, isn't she, Commander?"

Their eyes were in contact. "And he's a handsome man, isn't he, Tiffani? I want you to imagine that you have an uncontrollable desire to touch him, to kiss him, to be naked with him." Tiffani blushed. Winters fidgeted. Melvin was fairly certain that he saw a spark, albeit a fleeting one.

"Now tomorrow night," he continued, looking at Tiffani and taking his hand off theirs, "I want you to capture that feeling when you're hiding in his room. I want it to explode out of you when he notices that you are there. And you, Commander," he looked back at the middle-aged naval officer, "you are torn between an overpowering passion to possess this young girl physically and the almost certain knowledge that it will be the final ruination of both your life and your soul. You are hopelessly trapped. Remember, you fear that God has already forsaken you for your past sins. But, despite that, you finally relinquish yourself to your lust and commit another unpardonable sin."

Tiffani and Commander Winters both realized at virtually the same time that their hands were still intertwined. They looked at each other for a moment and then, embarrassed, awkwardly separated them. Melvin Burton slipped between his players and put his arms around their shoulders. “So go on home now and think about what I’ve said. And come back tomorrow and really break a leg.”

Vernon Winters drove the Pontiac into his driveway in suburban Key West just before eleven o’clock. The house was quiet, the only lights were in the garage and the kitchen. As regular as the stars, Vernon thought, Hap to bed at ten, Betty to bed at ten-thirty. In his mind’s eye he saw his wife go into his son’s bedroom, as she did every night, and fiddle momentarily with his sheets and coverlet. “Did you say your prayers?”

“Yes, ma’am,” Hap always answered.

Then she would kiss him good night on the forehead, turn out his light as she left the room, and go into her bedroom. Within ten minutes she would have changed into her pajamas, brushed her teeth, and washed her face. She would then kneel beside her bed, her elbows on the top of the blanket and her hands clasped right in front of her face. “Dear God,” she would say aloud, and then she would pray until exactly ten-thirty, moving her lips silently with her eyes closed. Five minutes later she would be asleep.

Vernon was aware of a vague disquiet as he walked through the living room toward the three bedrooms on the opposite side of the house from the garage. There was something stirring in him, something that he could not identify exactly, but he assumed it was associated with either the nervousness of opening night or the sudden return of Randy Hilliard to his life. He wanted to talk to someone.

He stopped at Hap’s bedroom first Commander Winters walked in quietly in the dark and sat on the side of his son’s bed. Hap was fast asleep, lying on his side. A tiny nightlight beside his bed illuminated his profile. How like your mother you look, Winters thought. And act. You two are so close. I’m almost a trespasser in my own home. He put his hand gently against Hap’s cheek. The boy did not stir. How can I make up for all the time I was gone?

Winters gently nudged his son awake. “Hap,” he said softly, “it’s your dad.” Henry Allen Pendleton Winters rubbed his eyes and then sat up quickly in bed. “Yes, sir,” he said, “is anything wrong? Is Mom all right?”

“No,” his father answered, and then laughed. “I mean yes. Mom’s all right. Nothing’s wrong. I just wanted to talk.”

Hap looked at the clock beside his bed. “Ummm, well, okay, Dad. What do you want to talk about?”

Winters was quiet for a moment. “Hap, did you ever read the copy of the script that I got for you and your mother, the one from my play?”

“No, sir. Not much,” Hap replied. “I’m sorry, but I just couldn’t get into it. I think maybe it’s above my head.” He brightened. “But I’m looking forward to seeing you in it tomorrow night.” There was a long pause. “Umm, what’s it about anyway?”

Winters stood up and looked out the open window. Beyond the screen he could hear the gentle susurration of the crickets. “It’s about a man who loses his place with God because he can’t or won’t control his actions. It’s about . . .” Winters turned his head around quick1y and caught his son eyeing the clock. A sharp emotional pain raced through him. He waited until it had abated and then drew a breath. “Well, we can talk about it some other time, son. I just realized how late it is.”

He walked to the door. “Good night, Hap,” he said.

“Good night, sir.”

Vernon Winters walked past his wife’s room to the third bedroom at the end of the hall. He undressed slowly, now even more aware than before of an unfulfilled longing. He thought for a fleeting second about waking Betty up to

talk and maybe . . . But he knew better. That's not her style, he said to himself, never was. Even before when we slept together. And after Libya and the dreams and tears at night who could blame her for wanting her own bedroom.

He slipped into his bed in his undershorts. The soothing melody of the crickets enveloped him. And besides. She has her God and I have my despair. There is nothing left between us except Hap. We couple as strangers. both fearing any discovery.

10

"THE communication room will close in five minutes. The communication room will close in five minutes." The disembodied, recorded voice sounded tired. Carol Dawson was weary herself. She was talking to Dale Michaels on the videophone. Photographs were strewn all over the desk underneath the screen and the video camera.

"All right," Carol was saying, "I guess I agree with you. The only possible way for me to decipher this puzzle is to bring all the photos and the telescope recording unit back to Miami. "She sighed and then yawned. "I'll come up there first thing in the morning, on the flight that arrives at seven-thirty, so that IPL can get an early shot at the recorded data. But remember, I must be back here in time to pick up the golden trident at four. Can the lab process all the data in a couple of hours?"

"That's not the hard part. Trying to analyze the data and piece together a coherent story in an hour or two will be the tough job. "Dr. Dale was sitting on the couch in the living room of his spacious condominium in Key Biscayne. In front of him, on the coffee table, was a magnificent jade chess board with green and white squares. Six carved chess pieces were still on the board, the two opposing queens and four pawns, two from each side. Dale Michaels paused and looked meaningfully at the camera. "I know how important this is to you. I've cancelled my eleven o'clock meeting so I can help you."

"Thanks," Carol said automatically. She felt a trickle of irritation. Why is it, she thought while Dale talked about one of his new projects at MOI, that men always demand gratitude for every little sacrifice? If a woman changes her schedule to accommodate a man, it's expected. But if a man revises his precious schedule it's a big fucking deal.

Dale droned on. Now he was enthusiastically telling her about a new Institute effort to survey the underwater volcanoes around Papua, New Guinea. Whew, Carol smiled to herself when she realized that Dale's self-centered focus was bothering her, I must really be beat. I believe I'm on the verge of being bitchy.

"Hey," Carol interrupted him. She stood up and started to pick up the scattered photographs. "Sorry to bring a halt to this party, but they're closing the room and I'm exhausted. I'll see you in the morning."

"Aren't you going to make a move?" Dale replied, pointing at the chess board.

"No, I'm not," Carol said, showing just a trace of anger. "And I may not ever. Any reasonable player would have accepted the draw that I offered you last weekend and gone on to more important things. Your damn ego just can't deal with the idea that one game out of five I can battle you to a tie."

"People have been known to make mistakes in the end-game," Dale answered, avoiding altogether the emotional content in her remark. "But I know you're tired. I'll meet you at the airport and take you to breakfast."

"Okay. Good night." Carol hung up the videophone a little brusquely and packed all the photographs in her briefcase. As soon as she had left the marina, she had taken her camera and film straight to the darkroom at the Key West Independent, where she had spent an hour developing and studying the

prints. The results were intriguing, particularly a couple of the blowups. In one of them she could clearly see four separate tracks converging to a spot just under the fissure. In another photo the bodies of the three whales were caught in a pose that looked as if they were in the middle of a deep conversation.

Carol walked through the spacious lobby in the Marriott Hotel. The piano bar was almost deserted. The lithe black pianist was playing an old Karen Carpenter song, “Good-bye to Love. “ A handsome man in his late thirties or early forties was kissing a Rashy young blonde in a nook off to the right. Carol bridled. The bimbo must be all of twenty-three, she said to herself, probably his secretary or something equally important.

As she wound her way down the long corridor toward her room, Carol thought about her conversation with Dale. He had told her that the Navy had small robot vehicles, some of them derived from original MOI designs, that could easily have made the tracks. So it was virtually certain that the Russians had similar vehicles. He had dismissed the whales’ behavior as irrelevant but had thought that her failure to find out if anything else was under the overhang had been a serious mistake. Of course, Carol had realized when he had said it, I should have spent another minute looking. Nuts. I hope I didn’t blow it. In her mind’s eye she then had carefully revisited the entire scenario at the overhang to see if there were any clues that something else may have been hidden there.

The biggest surprise in the discussion with Dale had come when Carol, in passing, had praised the way the new alarm algorithm had worked. Dale suddenly had become very interested. “So the alert code definitely read 101?” he had said.

“Yes,” she had answered, “that’s why I wasn’t that astonished when we found the object.”

“No way,” he had said emphatically. “The trident could not have caused the alert code. Even if it was at the edge of the field of view of the telescope, and that seems unlikely given how far you followed the trench, it’s too small to trigger the foreign object alarm. And how could it have been seen under the overhang anyway?” Dale had paused for a few seconds. “You didn’t look at any of the infrared images in realtime, did you? Well, we can process them tomorrow and see if we can figure out what triggered the alarm.”

Carol felt strangely defeated as she opened the door to her motel room. It’s just fatigue, she said to herself, not wanting to admit that her conversation with Dale had made her feel inadequate. She put her briefcase on a chair and walked wearily to the bathroom to wash her face. Two minutes later she was asleep on the bed in her underclothes. Her slacks, blouse, shoes, and socks were all stacked together in the corner.

She is a little girl again in her dream, wearing the blue-and-yellow striped dress that her parents gave her for her seventh birthday. Carol is walking around with her father in the Northridge Mall on a busy Saturday morning. They pass a large candy store. She lets go of his hand and runs into the store and stares through the glass case at all the chocolates. Carol points at some milk chocolate turtles when the big man behind the display case asks her what she wants.

In the dream Carol cannot reach the counter and doesn’t have any money “Where is your mother, little girl?” the candy store man asks. Carol shakes her head and the man repeats the question. She stands on her tiptoes and tells the man in a confidential whisper that her mother drinks too much, but that her father always buys her candy.

The man smiles, but he still won’t give her the chocolates. “And where is your father, little girl?” the candy store man now asks. In the case Carol can see the reflection of a kindly, smiling man standing behind her, framed between two piles of chocolates. She wheels around, expecting to see her father. But the man behind her is not her father. This man’s face is grotesque, disfigured.

Frightened, she turns back around to the chocolates. The man in the store is now taking the candy away. It is closing time. Carol starts to cry.

"Where is your father, little girl? Where is your father?" The little girl in the dream is sobbing. She is surrounded by big people, all of them asking questions. She puts her hands over her ears.

"He's gone," Carol finally shouts. "He's gone. He left us and went away and now I'm all alone."

CYCLE 447

1

AGAINST the deep black background of scattered stars the filaments of the Milky Way Galaxy seem like thin wisps of light added by a master artist. Here, at the far edge of the Outer Shell, near the beginning of what the Colonists call the Gap, there is no suggestion of the teeming activity of the Colony, some twenty-four light millicycles away. An awesome, unbroken quiet is the background for the breathtaking beauty of a black sky studded with twinkling stars.

Suddenly out of the void comes a small interstellar messenger robot. It seeks and finally finds a dark spherical satellite about three miles in diameter that is easily overlooked in the great panorama of the celestial sky. Time passes. A close-up reveals activity on the satellite. Soft artificial lights now illuminate portions of the surface. Automated vehicles are working on the periphery of the object, apparently changing its shape. External structures are dismantled and taken off to a temporary storage area in the distance. At length the original satellite disappears altogether and what is left are two long parallel rails of metal alloy, built in sections of about two hundred yards apiece from the spare parts of the now vanished satellite. Each rail is ten yards across and separated from its matched partner by about a hundred yards.

Regular sorties to the storage area continue until the useful supplies of material are depleted and the tracks extend for a distance of almost ten miles. Then activity stops. The rails from nowhere to nowhere in space stand as mute reminders of some major engineering activity suddenly abandoned. Or was it? From just below a prominent binary pair, the two brightest lights in the eastern sky, a speck emerges. The speck grows until it dominates the eastern quadrant of the sky. A dozen, no, sixteen great interstellar cargo ships with bright, flashing red lights lead a procession of robot vehicles into the region. The ghostly rails to nowhere are surrounded by the new arrivals. The first cargo ship opens and eight small shuttles emerge, each one moving back down the line toward another of the great cargo containers. The shuttles wait silently outside the huge ships while the entourage completes its arrival.

The final vehicle to arrive is a tiny space tug pulling a long, slender object that looks like two folded Japanese fans joined together end to end. It is encased in a transparent and protective sheath of very thin material. Eight small, darting vehicles dance like hummingbirds along its entire length, as if they were somehow guiding it, guarding it, and checking out its health all at the same time.

The large cargo ships shaped like ancient blimps now open and reveal their contents. Most of them are carrying rail sections stacked in enormous piles. The small shuttles unload the sections, leaving them stacked, and set them in groups stretching for miles in both directions from the existing rails. When the rail sections are almost all unloaded, four of the shuttles approach the side of one of the remaining giant cargo ships and wait for the bay doors to swing open. From the inside of this cargo ship come eight machines that attack each of the four shuttles in pairs, breaking them carefully into pieces and taking the parts back into the dark of the cargo bay. A few moments later, an

elongated complex of articulating machinery emerges from this great ship. Once released from the confines of the cargo carrier, it stretches itself into a long bench reaching almost a mile in length. Every hundred yards or so along the central platform of this bench, a smaller set of coordinated components form into highly organized local groups.

This is the automated, multipurpose construction system, one of the technological treasures of the Colonists. The entire system moves into place at the end of the tracks and its many remote manipulators begin to pull rail sections from the various stacks. Its sophisticated local hands and fingers deftly put the new sections in place and attach them with atomic welds. The speed is astonishing. An entire mile of new track is finished within minutes and the great builder moves to another group of rail section piles. The completed tracks extend for almost a hundred miles in space.

Having finished with one task, the construction system undergoes its next metamorphosis. Tearing itself into pieces starting from the two ends of the long bench, the monolithic structure disappears and is reorganized into thousands of separate but similar components. These little antlike contraptions attach themselves in groups to individual rail sections. They measure carefully all the dimensions and check all the welds between adjacent sections. Then, as if on cue, the rails on the four ends of the track segments begin to bend and elevate, lifted by the antlike components. The rails twist upward, upward, bringing the rest of the track with them. The two long parallel lines are eventually transformed into a giant double hoop, over ten miles in radius, that looks like an amusement park ferris wheel suspended in space.

With the completion of the double hoop, the construction system again reconfigures itself. Some of the new elements of the system pick up the long slender object shaped like end-to-end Japanese fans. They erect it near the hoop (it is, not surprisingly, almost the exact length as the diameter of the hoops) under the careful surveillance of its hummingbird protectors. Then the object is hoist into place as a north-south spoke in the double hoop structure. Some of the hummingbirds produce unseen thin cables and anchor the spoke to the hoop structure at both ends. The rest of the tiny mechanical speedsters create a web that winds around the center section and connects the great antenna with the east-west axis of the hoops.

The antenna, now connected to its supporting structure, opens slowly at both the north and south pole positions on the hoop. Closer inspection reveals that the hummingbirds are actually pulling the delicate individual folds apart. The folds spread out until the entire interior of the hoops is covered with a mixture of mesh, ribbing, and amazingly complex local arrays. The initial deployment is complete.

The communication complex next goes through an elaborate self-test while its construction minions stand by in case any problems are encountered. The tests are successful and the station is declared operational. Within hours the phalanx of robot emissaries from the inhabited universe picks up all the stray metal lying around and packs it into one of the large cargo ships. Then, as swiftly as they came, the robot vehicles disappear into the blackness around the station, leaving the imposing hoop structure alone as a reminder of the presence of intelligence in the universe.

Around the vast Outer Shell, whose two hundred and fifty-six sections each contain more volume than the Colony, over one thousand similar upgrades have been made during Cycle 446 in an attempt to extend advanced communications capabilities to new locales. This is the last upgrade of a very difficult group in a region near the Gap. This group was delayed several times because of an unacceptably high number of manufacturing deficiencies at the nearest major factory over two light millicycles away. After several attempts to diagnose and repair the problems, eventually the plant had to be closed and virtually rebuilt from scratch. The total delay to the completion of the project was fourteen

millicycles, just about what the Council of Engineers had predicted in their worst-case analysis that accompanied the Cycle 446 Proclamation.

* * * * *

As the big moment approaches, all normal activity in the heart of the Colony ceases. In the last nanocycle, there is no business activity, no entertainment. The spaceports are even empty. At precisely 446.9, after two hundred millicycles of debate and discussion by the Council of Leaders, the governmental blueprint for the next era will be delivered and all intelligence in the Colony will be listening.

The giant transmitter is activated on schedule and the Cycle 447 Proclamation pours out at an information rate of a hundred trillion bits of information per picocycle. The actual data rate from the powerful source is much higher, but the information rate is reduced to accommodate requirements for both sophisticated encoding and error checks internal to the data. With the coding, only Colony receivers equipped with special decryption algorithms can unscramble the message at any level. And the internal consistency checks on each packet of data in the transmission reduce the probability of receiving an erroneous piece of information, even at an enormous distance, to practically zero.

Following the organization and agenda for The Proclamation established in the Era of Genius, between Cycles 371 and 406, the first microcycle of the transmission is a complete summary of the entire plan. Two hundred nanocycles of this summary are devoted to each of the five divisions governed by the Council of Leaders: administration, information, communication, transportation, and exploration. After a planned break of four hundred nanocycles, to allow receiver adjustments along the path of the signal, the transmission of the actual Cycle 447 Proclamation begins. On and on it goes. It does not stop until twenty microcycles later. Four complete microcycles are used for in-depth explanations of the major projects to be undertaken in each of the five disciplines. Of particular interest to the Committee for the Outer Shell, the group that governs the huge concentric region defining the most distant reach where the Colonists claim jurisdiction, is a plan from the Division of Exploration announcing the repatriation to the Outer Shell of almost a million species from Zoo System #3.

(The transmission of The Proclamation, a wealth of information that can be translated into language, pictures, sounds, and other sensory impressions depending on the receiving beings and the sophistication of their decryption equipment, is the beginning of the governmental process for each cycle. Based upon The Proclamation, regional bodies or administrative agencies with subordinate jurisdictions then adjust their plans for the cycle to be consistent with those announced by the Council of Leaders. This procedure is defined in detail in the Articles of Colonial Confederation.)

The Proclamation is relayed throughout the Colony and the near reaches of the Inner Shell by means of giant communication stations along the developed transportation routes. These stations, actually information centers that store all Colony messages in their extensive libraries for as long as a hundred cycles, amplify and retransmit the signal to the next station in the pattern some ten light microcycles away. The edge of the Colony (and hence the beginning of the Inner Shell) was expanded by the Boundary Decree in the Cycle 416 Proclamation to include all points up to three light millicycles from the administrative center. Thus, by the time the Proclamation reaches the mammoth Zoo Complex, a combination of three stars and nineteen planets (four of them artificial) just across the edge of the Colony, the message has been relayed through three hundred stations.

The Committee of Zookeepers eagerly awaits the proclamation to find out the response to their recommended expansion of the Zoo Complex. They are surprised to find their proposal replaced by another repatriation plan. Once before, in Cycle 429, they had proposed an expansion of the zoo to handle the explosion of successful progeny created by the breakthroughs in adaptive genetic engineering during Cycles 426-428. At that time also their request had been denied and the Council of Leaders had recommended repatriation to solve the population problem. During Cycles 430-436 the population of the Zoo Complex was kept approximately constant by these regular transfers of common species back to their original homes

But starting with Cycle 437, there was a rapid increase in interest in comparative biology. It was triggered by the discovery of a fifth class of life form, called Type E by the Council of Biologists, in Section 28 of the Outer Shell. Subsequent expeditions to the same area showed not only that the dominant life type throughout Sections 28-33 was Type E. but also that Type A was surprisingly present as well in those sections. This was the first time that natural evolution in any region had shown a predilection for any kind of life form other than the Type A of the Colonists and its developed hybrids. The quest to understand these unusual creatures led to the endangered species expeditions in the Outer Shell in Cycles 440 and 441 and the creation, in Cycle 442, of several worlds specifically to study the new Type E life forms.

Many of these new species flourished in Zoo System #3, causing population and space problems again for the Committee of Zookeepers. The space shortage was especially severe and it was exacerbated both by the need to segregate all the Type E life forms and by their rapid reproduction. Therefore, at the beginning of the planning process for this Cycle 447, the Committee of Zookeepers had proposed their small expansion of the Zoo Complex, suggesting not only a fourth zoo system completely dedicated to Type E life forms, but also a vigorous campaign for completing the repatriation of all Colony and Inner Shell species with aggression coefficients below 14.

The Committee of Zookeepers are stunned by the scale of the Outer Shell repatriation plan contained in the Cycle 447 Proclamation. In a lively technical discussion catalyzed by the unexpected proposal, the dangers of returning the Outer Shell life forms to their original planets are vigorously reasserted. The Committee decides tentatively to take an unusual step-to submit a Proclamation Variance to the Council of Leaders. In the draft variance the Zookeepers point out that many genetic experiments have been conducted with the new Type E forms, that the evolutionary possibilities for the new species are therefore uncertain, that the monitoring frequencies and test facilities in the Outer Shell are inadequate, and that the aggression coefficients for many of the group are not yet accurately tabulated

Before they actually submit the variance, however, the Committee of Zookeepers realizes that someone must have pointed out all these factors in the original debates. So why was the repatriation policy promulgated? Was this part of some new overarching design that downgrades the importance of zoological information altogether? Or is the policy strictly political and possibly connected with the Message from Power #2?

IN keeping with the laws of the Colony governing the dissemination and preservation of important historical information, the official commentary of key Council-level organizations accompanies the transmission of the Cycle 447 Proclamation. Of particular interest to those involved in the Outer Shell repatriation project are the following excerpts from the report of the Council of Engineers:

. . . The earliest repatriation to the Inner Shell was done on almost an ad hoc basis, simply transporting the life forms, en masse, to their original region or another of similar environment in a nearby sector. This was accomplished by conducting a roundup of the tranquilized creatures at their zoo habitats, loading them into huge cargo vessels maintaining internal conditions equivalent to the habitat, and then dispersing them at their new home. This process worked adequately for small transfers over short distances. It was also cheap. However, it had many severe deficiencies that rendered it almost useless for sustained operations.

First and foremost, the ontogenetic development of the creatures was completely interrupted by the repatriation procedure. They were frightened by their removal, disturbed by their necessarily reduced locus of movement during transit, and, once situated in their new locales, bothered by even minute differences from their earlier homes. Their memories, even if electronically cleansed, retained an intense sense of 1098 that undermined their adjustment. All these conditions taken together led to a marked phylogenetic increase in aggression coefficient, across the board, that did not significantly damp in some of the species for ten to fifteen generations. . . .

. . . From the point of view of spacecraft design, both the size and distance of the proposed transfers precluded using mature specimens long before the biological and developmental problems were thoroughly understood. When the Cycle 432 Proclamation called for increased repatriation within the Colony and the Inner Shell, there was some panic at the Council of Engineers because it was thought that transportation vehicles on a near planetary scale might be required. Fortunately, the Committees on Biological Engineering and Advanced Robotics proposed that future transfers be accomplished using suspended zygotes together with new versions of the superintelligent robots serving as zoo monitors.

After a few early problems with the zygote technique, It was more or less perfected, at least for the Types A and B life forms 90 prevalent in the Colony. Repatriation success ratios for the last ten cycles are very high, even for the more difficult types C and D. However, such success ratios should not be expected in the implementation of the Cycle 447 Proclamation. Not only are some of the target life forms the newest and least understood in the Zoo Complex, but also they will be repatriated, in many cases, to a distant, poorly documented biological environment where monitoring is as infrequent as every three or four hundred millicycles. Some of the more advanced Type E forms have amazingly short life spans for lntelligence, as little as five or six millicycles, which means that fifty to a hundred generations may elapse between progress checks. . . .

. . . But all in all it is a magnificent challenge for engineering. Many transfer vehicles will fly well outside the standard transportation infrastructure and therefore must be able to forage raw materials on their own. Conditions at the target worlds may have changed, so adaptability and the processing of new information will play a critical role in the design. The electronic components will have more failures due to the long flight times, meaning that extraordinary fault correction systems must be developed and tested. . . .

And from the Council of Historians:

It is useful to begin our mostly negative comment on the Outer Shell repatriation plan by reminding all Colonists that our Council includes the longest continuously active intelligence pool of any Council In the Directory. Two of our groups have direct memories of the Era of Genius through many generations of biological refresh. Thus it is natural that our approach to any

proposed project is to assess its merit in terms of its role in the overall evolution and/or strategy of our society. It is not our desire to dampen the youthful zeal that thrills at the acquisition of new knowledge or the prospect of great adventure; rather, we would like to place a sense of perspective on all Colony endeavors and measure the future impact of any perceived changes in basic policy. . . .

. . . The proposed repatriation scheme is still another step in the dangerous folly of unbridled frontierism that began, in our opinion, with the Boundary Decree of Cycle 416. Instead of discussing the details of the proposed plan without reference to its historical context (there are excellent descriptions of the elements of the plan in the report by the Council of Engineers — some of the significant short-term risks are listed in the report by the Council of Biologists), we wish to delineate its dangers by including it in our broad indictment of the entire genus of adventures spawned by the Boundary Decree. . . .

. . . The justifications advanced for frontierism always sound good on the surface. Its proponents point out that societal change is produced by new information outside the ordinary sweep of events, that frontierism is essentially aimed at producing this kind of new knowledge, and that the resulting change in perspective that comes from a 'new view of the universe' forces the proper and regular reassessment of our culture.

History is usually in general agreement with the advocates of frontierism and that is doubtless why this repatriation proposal and similar other previous exploration activities have been so enthusiastically supported. However, there are limitations to the benefits redounding from new information, especially when frontier investigations reveal knowledge that is either inimical to the fundamental structure of the society or beyond the comprehension of the most learned groups. In these cases the diffusion through the society of the new information is unsettling, instead of being enriching and uplifting, and actually undermines the security of the established institutions.

A perfect example of what happens when frontierism is embraced without constraint can be seen in the events of the last thirty cycles that led to the receipt of the message from Power #2 in the middle of Cycle 444. The Boundary Decree initiated the process by establishing, in effect, a new Jurisdictional domain for the Colonists. The old central Colony had no rigorous boundary. Significant development extended out to only two light millicycles distance from the administrative center. The outermost permanently maintained station was at that time a mere ten light millicycles away. The Decree of Cycle 416 regularized the nearby universe, creating four concentric worlds and expanding the central Colony itself to a radius of three light millicycles. Three specific Shells were also created, with the Outer Shell defined to be the entire region between twelve and twenty-four light millicycles away from the administrative center.

This Outer Shell contained fifty thousand unexplored star systems in a volume a thousand times greater than that of the old central Colony. During the period between Cycles 425 and 430, almost half of the major initiatives identified in the cyclical proclamations were involved, in one way or another, with the exploration of the Outer Shell. (It should be pointed out that during those five cycles there was also documented speculation that such a rapid expansion in our knowledge base might have unforeseen ramifications, but the negativists, as they were called, were drowned out by the collective fascination with the exploratory binge.) men, in Cycle 433, our new class of interstellar drones, specifically designed to study and categorize the many worlds of the Outer Shell, encountered a large, quiescent spacecraft of unknown origin. Careful in situ investigations were unsuccsssful in their attempts to correlate the engineering components of the spaceship with any known technological base for a spacefaring species.

Eschewing the caution suggested by many of the Committees, the Council of Leaders had the enigmatic spaceship towed back to one of the developed cities of the Inner Shell. There it was placed on display and analyzed in detail. The initial conclusion of the drones was validated. The spacecraft had not come from anywhere inside the domain of the Colony. The Council of Engineers concluded that the technological capabillty of this builders was roughly equivalent to that of the Colonists in the early Era of Genius. But when had it been made? And where did it come from? And most importantly, who had made it?

By deciding to bring the dead spaceship back to civilization, the Council of Leaders basically guaranteed that the unsettling question of its origin would remain uppermost in the minds of the Colonists. This unbridled quest for any and all information again worked to destabilize the culture. The entire society was rife with rumored explanations to the unanswered and disquieting questions raised by the spaceship. The dominant opinion was that the craft had been a Colonial prototype, never put into production, that had somehow been omitted from the official Encyclopedia of Space Vehicles. This opinion was consistent with the general tendency of the Colonists to believe they were innately superior to all other life forms.

It might have been possible to let the doubts and fears about the unknown spacecraft diminish to nothing, but the Council of Leaders resuscitated the collective anxieties by announcing, in the Cycle 434 Proclamation, that the largest new project of the Colony would be the design and eventual deployment of a new generation of receiver arrays in the Outer Shell. The purpose of these arrays would be to intercept and decode any coherent radio messages that might be emanating from inside the Gap. It was a clear indication that the leadership believed the silent spaceship to be of extracolonial origin.

In Cycles 435 and 436 wave after wave of disturbing information staggered the Colony. First there was the premature announcement that many extracolonial messages had been decoded. This disclosure supported the widespread rumor of multiple Powers in the galaxy, some of them far more evolved than the Colony. This frightening concept lingered for half a cycle before the Council of Astronomers, responding to these proliferating half-truths, finally announced that all but a handful of the messages could be ascribed to a single power, Power #2, whose center of activity appeared to be about two hundred light millicycles away. Shortly thereafter their next astonishing announcement unambiguously identified Power #2 transmissions coming from sources as far as one hundred and fifty light millicycles apart, or more than three times the diameter across the entire Colony Jurisdiction!

Between Cycle 438 and the receipt of the message, the Council of Leaders ignored advice that the Colony should carefully husband its resources while analyzing the impact of the discovery of the strange spaceship. Crash programs were instituted in advanced encryption, it is true, primarily to allay concerns that Power #2 might be monitoring all our transmissions. This action was widely hailed as a step in the right direction. However, at the same time the exploration of the Outer Shell was intensified, leading to the identification of the new Type E life forms and the subsequent, thinly disguised endangered species roundup. All suggestions to retrench and slow down the exploration program were ignored. In Cycle 442, in fact, the Zoo Complex created several artificial planets just for the conduct of genetic capabilities experiments with the Type E species.

Then came the Message from Power #2. So simple, so straightforward, so terrifying. It was coded in our most advanced encryption algorithm. It acknowledged our mutual awareness of one another and suggested opening up bilateral communications. Nothing else. End of Message. . . .

. . . It is not fear of hostility from Power #2 that motivates our objection to continued exploration in the Outer Shell. On the contrary. We as historians think the nascent concern about the possible aggressiveness of Power

#2 is unfounded. Study after study has shown that there is a significant positive correlation between high aggression coefficient and inability to evolve into a society with a purview greater than a single solar system. In fact, the probability that a society as advanced as ours could have retained aggression and territoriality as constituents in its overall psychological makeup is vanishingly small.

Nevertheless, such monumental events as the receipt of the message from Power #2 call for reflection and synthesis, not additional exploratory activities. We should be using our resources to study and understand the entire range of impacts that the message will have on our society, not squandering them on bold repatriation schemes. It is a question of priorities and once again the advocates of frontierism, exalting new information and technological development over the stability of the society, are blind to the downside risks of their endeavors. . . .

FRIDAY
1

NICK Williams woke up at five o'clock in the morning and could not go back to sleep. His mind was too active, racing over and over the events of the day before and the possible outcomes of the day ahead. The same phenomenon had occurred often when he was in high school in Virginia and then a few times later, at Harvard, usually just before big swimming meets. If he had too much excitement running through his system, his brain would not turn off enough to let him sleep.

He lay in bed for almost another hour, alternately trying to coax himself back to sleep and indulging his fantasy that what he had found the day before was just the first item in a vast cache of valuable treasure. Nick loved to fantasize. It was always easy for him to see, in his mind's eye, all the scenes in the novels that he loved so much to read. Now for a moment he imagined headlines in the Miami Herald announcing his discovery of a hoard of sunken gold off the coast of Key West.

Around six o'clock Nick gave up trying to sleep and climbed out of bed. The little exercise bag was next to the dresser. He pulled the golden trident out to look at it, as he had done four or five times the night before. What was this thing? he asked himself. It must have had some practical use for it's too damn ugly to be ornamental. He shook his head. Amanda will know. If anyone can tell me where this thing came from, she can.

Nick walked across his bedroom to the sliding glass doors and opened the curtains. It was almost sunrise. Beyond the small balcony outside he could see the beach and the ocean. His condominium was on the third floor and had an unspoiled view of the quiet surf. Above the water a couple of brown pelicans soared in graceful formation, waiting for a chance to descend into the water and catch some unsuspecting fish swimming too close to the surface. Nick watched a couple in their seventies walking slowly along the beach. They were holding hands and talking quietly; a couple of times the woman broke away to pick up a shell or two and put it in a small Ziploc bag.

Nick turned away from the door and grabbed the jeans that he had dropped on the floor the night before. He pulled them on over his undershorts and walked into the living room carrying the bag with the trident. He put the golden object carefully on the table where he could study it, and then went back into the open kitchen to start the coffee maker and turn on the radio.

Except for the books, Nick's living room was decorated just like hundreds of Florida seaside condominiums. The couch and easy chair were comfortable and bright, cream in color with a couple of light green ferns in the pattern for decoration. Two small paintings of water birds standing on an empty beach

adorned the otherwise empty walls. Light beige drapes that matched the carpet framed the long sliding glass doors that led to the balcony with the rattan patio furniture.

It was the books that gave the apartment some individuality. Along the wall opposite the couch, between the living room and the bedroom, was the large wood bookcase. It stretched almost all the way from the sliding glass doors in front of the balcony to the bedroom door. Although the general appearance of the apartment was one of disarray (newspapers and sports magazines strewn about here and there on the coffee table, clothes and towels on the floor in the bedroom and the bathroom, dirty dishes in the sink, the dishwasher standing open half full of dishes), the bookcase area was clearly well maintained. Altogether there must have been four or five hundred books on the four shelves of the long bookcase, all paperbacks, virtually all novels, and all carefully filed according to category.

In front of each group of books, Scotch-taped to the outside of the bookshelf, was a sheet of paper identifying the category. Nick had finished A Fan's Notes on the boat on Thursday and had already put it back in its proper place on the shelf (in the category of "American, 20th Century, A-G") right next to a dozen or more books by William Faulkner. He had then selected for his bedtime reading a nineteenth-century French novel, Madame Bovary, by Gustave Flaubert. Nick had read the book once before, during his sophomore year at Harvard, and had not thought that much about it. However, he had been recently surprised to find the book on several lists of the ten finest novels of all time, ranking right up there with such masterpieces as Crime and Punishment by Dostoevsky. Hmm. Perhaps I missed something the first time, he had told himself the previous night before deciding to read it again.

But Nick had not been able to focus on the magnificently detailed descriptions of life in provincial France a hundred and fifty years earlier. As he had followed the story of the lovely Emma Bovary, a woman for whom the stultifying sameness of her life was cause enough to have affairs that would eventually scandalize her village, the excitement of Nick's own life, for once, kept intruding. He was unable to suspend himself in the novel. His mind kept returning to the possibilities offered by the golden object in the exercise bag.

Nick turned the object over and over in his hands while he drank his morning coffee. Then he had an idea. He walked back to the second bedroom, just opposite the kitchen and next to the laundry room, and opened the closet door. Nick used most of this closet as a storage area. In the corner of the closet were four huge cardboard boxes of junk that he had brought with him when he had bought the condominium seven years earlier. He had never opened them even once in the intervening time. But he did remember that in one of those boxes were a bunch of photographs of the objects they had brought up from the Santa Rosa. Maybe if I look at those pictures, he thought to himself as he struggled to find the right container in the dimly lit closet, I will see something that looks like that thing.

He finally located the correct box and dragged it out into the middle of the living room. At one time its contents might have been well organized, for there were manila folders with filing labels inside. But almost all of the papers and photos and newspaper clippings had fallen out of their original places and were now scattered around the box in a loose jumble. Nick reached in and pulled out a clipping from the Miami Herald. It was yellow from age and had been crammed down into one of the corners. Five people, including Nick, were featured in a big photograph on the front page.

Nick stopped for a moment and looked at the photo and the caption. Has it really been that long? he wondered, Almost eight years since we found the Santa Rosa. The caption identified the five individuals in the photograph as the crew of the Neptune, a dive and salvage boat that had found an old Spanish ship named the Santa Rosa sunk in the Gulf of Mexico about fifteen miles north of the Dry

Tortugas. Gold and silver objects worth more than two million dollars had been retrieved from the vessel and were piled in front of the happy smiling crew. From left to right they were Greta Erhard, Jake Lewis, Homer Ashford, Ellen Ashford, and Nick Williams.

That was before they started eating, Nick thought to himself. Ellen ate because of Greta, because it gave her an excuse in her own mind for what was happening with Homer. And Homer ate because he could afford it. Just like he does everything else. For some people constraints are the only thing that saves them. Give them freedom and they go berserk.

Nick dug deeper into the box, looking for a set of twenty or so photographs that showed most of the large gold items they had retrieved from the Santa Rosa. Eventually he started finding some of the pictures, in groups of four or five, in different parts of what was now becoming a hopeless pile at the bottom of the box. Each time he would find some more photos, he would pull them out, look at them carefully, and then shake his head to acknowledge that the golden trident did not look a thing like any of the objects from the Santa Rosa.

At the bottom of the box Nick encountered a yellow manila folder with a rubber band wrapped carefully around it. Thinking at first that this folder might contain the rest of the pictures from the Santa Rosa, Nick pulled out the folder and opened it hastily. An 8 x 11 picture of a beautiful woman in her early thirties slid out and fell on the living room floor. It was followed by handwritten notes, cards, a few letters in envelopes, and then about twenty sheets of bond paper covered with double-spaced typing. Nick sighed. How was it possible that he hadn't recognized this folder?

The woman in the portrait had long black hair, lightly frosted in the front. She was wearing a dark red cotton blouse, slightly open at the top to show a triple strand of pearls just under the neck. In blue ink that contrasted with the red of the blouse, someone with magnificent, clearly artistic hand-writing had written, "Mon Cher — Je t'aime, Monique," across the lower right portion of the photograph.

Nick bent down on his knees to pick up the scattered contents of the folder. He looked at the portrait carefully, his heart skipping a few beats as he remembered how beautiful she had been. He started to sort the typed pages together. At the top of one of the pages was written, in all capital letters, "MONIQUE," and then underneath it, "by Nicholas C. Williams." He started to read.

"The wonder of life lies in its unpredictability. Each of our lives is irrevocably changed by the things we cannot have possibly forecast. We walk out of the door every morning to go to work or to class or even to the grocery store, and ninety-nine times out of a hundred we return without anything having happened that we will remember even a month in the future. On those days our lives are swept up in the banality of living, in the basic humdrum cadence of everyday existence. It is the other day, the magic day, for which we live.

"On this magic day our character becomes defined, our growth is accelerated, our emotional transitions are made. Sometimes, maybe once in a lifetime, there will be a string of these magic days, one after another, so full of life and change and challenge that we are completely transformed by the experience and our souls become suffused with a boundless joy. During that time we are often overcome by the simple and incredible miracle of just being alive. This is the story of one such magic period.

"It was spring break in Fort Lauderdale. Our swimming season had just finished at Harvard and my uncle, as a present for my twenty-first birthday, offered to let me use his condominium in Florida for a couple of weeks so I could unwind from the twin rigors of studying and swimming practice . . ."

Nick had not looked at these pages for almost ten years. As he read the first few paragraphs he remembered, vividly, the ecstasy in which they were written. It was two nights before the party. She was at some social function

that night, would be too late, would come by first thing in the morning. I couldn't sleep. It was the first night in a week I had been away from her. He stopped for a moment, old emotions twisting around inside him, making him feel dizzy and slightly nauseous. He read the first paragraph again. It was also before the pain. Before the incredible goddamn pain.

For almost thirty minutes music had been playing on the radio. Nick had heard it, he knew it was there, but he could not have identified any of the songs. It had been background music. Now, just at the moment when his memories of Monique were the most poignant, the Miami "classic rock and roll station, WMIM, 99.9 on your FM dial," played Cyndi Lauper's haunting 1984 hit "Time After Time." The music seemed to increase markedly in amplitude. Nick had to sit down and grab a breath. Until the song, he had been able to deal with his memories of Monique. But somehow that song, the one he had played on the cassette player in his car almost every night as he had made the drive from Fort Lauderdale to Palm Beach to see her, carried with it all the youthful love, joy, fear, and anger that had marked the entire affair. Nick was overwhelmed. As he sat on the couch and listened to the song, hot tears welled up in his eyes and then ran softly down his cheeks.

". . . Lying in my bed, I hear the clock tick, and think of you . . . Caught up in circles, confusion is nothing new . . . Flashback, warm nights, almost left behind . . . Suitcase of memories . . . Time after Time."

2

YOU say, go slow, I fall behind. . . . The second hand unwinds . . ." Brenda leaned over and turned the volume down on the cassette player. "It's me, Mr. Stubbs, honest. Brenda Goldfine. Don't you recognize me?" She was shouting at an old man in a blue uniform who was sitting on a stool in a small circular tower in the middle of the road. "And that's Teresa Silver in the back. She's not feeling too well. Come on, open the gate and let us through."

The security guard climbed down from his stool and slowly walked out in front of Nick's old Pontiac. He wrote the license number down on a note pad and then came around to Brenda's window. "All right this time, Brenda, but this is not according to the rules. All visitors coming into Windsor Cove after ten o'clock at night must be cleared ahead of time."

At length the guard raised the gate and Nick moved his car forward again. "The guy's really a pain in the ass," Brenda said to Nick, smacking her gum as she talked, "Christ, you'd think he owned one of the places or something." Nick had heard about Windsor Cove. Or rather had read about it. Once when he was over at his uncle's home in Potomac, Maryland, there had been a copy of Town and Country magazine on the table and he had read about the "gracious life of Windsor Cove." Now, as he drove past the estates in the most prestigious section of Palm Beach, he was awed by the personal wealth displayed.

"Over there. That's Teresa's house." Brenda pointed at a colonial house set back about a hundred yards from the road. Nick drove into the long semicircular driveway and eventually stopped in front of a walkway leading to the front of the house. It was an imposing place. Two full floors, six white columns over twenty feet high, an opulent door whose top half was an arched, stained glass window of a white heron in flight against a blue sky filled with fleecy clouds.

Brenda looked in the back of the car where her friend was passed out. "Look, I'd better handle this. I'll go up and talk to Mrs. Silver and explain what happened and everything. Otherwise you could be in deep shit. Sometimes she jumps to conclusions."

By the time Brenda reached the front door to ring the bell, it had already opened. An attractive woman in a red silk blouse and a pair of chic black

slacks was waiting. Nick guessed that she had probably been called by the security guard. He couldn't tell much about the conversation, but he could see that Teresa's mother was asking questions. After a couple of minutes, Brenda and the woman came back to the car. "You didn't tell me she was still passed out," Nick heard a surprisingly husky voice say. There was also some kind of accent, European perhaps. "You know, Brenda, this is absolutely the last time she can go anywhere with you. You just can't control her. I'm not even sure that you try." The voice was angry but not strident.

Nick opened his door and climbed out of the car. "This is the guy I was telling you about, Mrs. Silver," Brenda said. "Without him Teresa might still be lying on the beach."

Mrs. Silver extended her hand. Nick took it, feeling a little awkward. He didn't know how to shake hands with a woman. "I understand that I'm in your debt, young man," Mrs. Silver said graciously. "Brenda tells me that you rescued Teresa from all sorts of horrors." The light from the street lamps played about her sculptured face. Her hand was soft, sensual. Nick smelled just a trace of perfume, something exotic. Her eyes were fixed on his, unwavering, inquisitive.

"Yes, Ma'am," Nick said clumsily. "I mean, well, she had had too much to drink and I thought the crowd of teenagers she was with were a little bit out of control." He stopped. She was still watching him, measuring him. He was becoming agitated and didn't understand why. "Somebody had to help her and I just happened to be there . . ." He trailed off weakly.

Mrs. Silver thanked him again and turned to Brenda. "Your mother's expecting you, dear. We'll stay out front until you get home. Flash your lights to let us know you're there." Brenda looked happy to be dismissed. She scampered off into the night in the direction of the nearest house about a hundred yards away.

There was a momentary pause as they watched the sixteen-year-old disappear into the night. Nick found himself stealing furtive looks at Mrs. Silver's profile. An inchoate awareness of what he was feeling made him more nervous. Jesus, she's beautiful. And young. How could she be the girl's mother? He was wrestling with a jumble of thoughts as he saw the lights flicker in the distance.

"Good," she said, turning to Nick with a smile, "Brenda's home. Now we can worry about Teresa." She stopped for a moment and laughed. "Oh, I almost forgot. We haven't been formally introduced. I'm Teresa's mother, Monica Silver."

"I'm Nick Williams," he said in response. Her dark eyes were fixed on him again. In the reflected light the expression in her eyes seemed to vary. One moment she was a pixie, then a seductress, then a very proper Palm Beach society woman. Or was Nick imagining it? He couldn't return her gaze anymore. He felt his cheeks flush as he averted his eyes.

"I had to carry her from the beach to the parking lot," Nick said abruptly, as he went around to the back door of his car and opened it. The teenager had been leaning against the door and nearly fell out. She didn't stir. He picked Teresa up and threw her over his shoulder. "So it's no problem for me to carry her for you now. I'm used to it."

They walked quietly down the path toward the house, Monica Silver leading by a few steps. Nick watched her walk in front of him. She moved effortlessly, like a dancer, with almost perfect posture. Her dark hair was wrapped up at the back in a chignon. It must be very long, he thought to himself with delight, imagining her hair flowing down her beautiful back.

It was a warm and humid Palm Beach evening. Nick was sweating by the time they reached the entrance. "Could you do me one more favor, Nick?" Mrs. Silver asked. "Could you carry her up to her room? My husband's not here and the help has all gone to bed. And I doubt seriously if she's going to get herself

together well enough to climb the stairs, even with my help, in the near future."

Nick followed Mrs. Silver's instructions and carried Teresa through the atrium, into the living room, up the entry steps onto the platform, up the left flight to the second floor, and then into her bedroom. It was huge. In her room Teresa had a king-size bed with four posters, a giant television, an entire cabinet of movies for the VCR, and a sound system that would have been a credit to any rock and roll band. Bruce Springsteen posters and photos were all over the room. Nick laid Teresa gently on her bed. She murmured "Thank you," indicating to him that at least she was semiconscious. Her mother bent over her and gave her a kiss.

Nick left the two of them alone and went back down the stairs into the living room. He could not believe that somebody really could live in a house like this. Why the living room alone was bigger than the house in Falls Church where he grew up. He wandered around the room after he came down the stairs. There were original paintings on the walls, crystal glass chandeliers hanging from the ceiling, and art objects and bric-a-brac both on the tables and in every nook and cranny. It was all too much for him. He was overwhelmed.

He felt a hand on his shoulder and involuntarily recoiled. Monica Silver chided him, "Goodness, you're jumpy. It's only me. " He turned around to look at her Was he imagining it or had she somehow combed her hair and put on fresh makeup in the few seconds they had been separated? For the first time he saw her in the full light. She was the most beautiful woman that he had ever seen. His breath was taken away and he felt giddy. Outside he had not been able to see her skin clearly. Now he found himself staring at her bare arms, following the elegant contours of her neck. Her skin had the smoothness of ivory. It called to him to touch it. Watch yourself, Williams, he heard a voice inside him say, Or you are going to be outrageous. He tried to calm himself.

But it was useless. He could not take his eyes off her. She was saying something. She had asked him a question. He had not even heard it, so dumbfounded was he by what was happening, by where he was. She was leading him somewhere in the house. His imagination was running wild. She took him into a small room with a table and told him to sit down.

"It's the least I can do," she was saying, "to repay you for what you did for Teresa. I know you must be hungry. And we still have some great food left over from the party tonight."

Nick was in a breakfast nook just off the kitchen. To his left a door led to the patio and then outside, into the back yard. The lights around the huge swimming pool were still on. He could see manicured gardens with roses in bloom, chaise longues, colorful umbrellas, white iron tables with twisted, lacy legs — he could not believe that it was all real. He felt transported to another world, a world that existed only in books and movies.

Monica Silver laid out some food on the table. Smoked salmon, onions, capers, cream cheese, two different kinds of bread, plus a dish of some other kind of fish that Nick did not recognize. "That's marinated herring," she said with a smile, noticing Nick's quizzical expression. She handed him a wine glass. He took it and unconsciously looked her straight in the eyes. He was transfixed. He felt weak and powerless, as if he were being drawn into her deep brown, bewitching eyes, into her world of richness and luxury and beauty. His knees were weak, his heart was racing, he could feel his fingers tingling

She poured some white wine in his glass and then in her own. "This is a brilliant Burgundy, Clos des Mouches," she said, touching her glass to his with a light tinkle. "Let's make a toast."

She was radiant. He was enthralled. "To happiness," she said.

They talked for over three hours. Nick learned that Monica Silver had grown up in France, that her father had been a small, struggling fur merchant in

Paris, and that she had met her husband, Aaron (the biggest of the big Montreal furriers), while helping her father at the shop. She had been seventeen at the time of the whirlwind courtship. Mr: Silver had proposed just seven days after they had met and she had accepted immediately even though her husband-to-be was twenty years older. She moved to Montreal and married him before she was eighteen. Teresa was born nine months later.

Nick told her that he was in his junior year at Harvard, majoring in English and French to get a good liberal arts education and prepare himself for either law school or graduate school. As soon as she found out that he was in his third year of French, she switched and spoke to him in her native language. Her name became Monique. He missed some of what she said, but it didn't matter. He understood the gist of it. And her dramatic voice plus the sound of the foreign language only increased the power of the spell already cast by the wine and her beauty.

Nick also tried to speak French from time to time. Whatever self-consciousness he might have ordinarily felt was swept away by the magic of the setting and their growing rapport. They laughed together easily at his mistakes. She was gracious and charming when she corrected him, always adding "mais vous parlez fran,cais tres bien" in the early part of the evening. Later, as their conversation became more personal (Nick talked about his problems with his father; Monique wondered aloud if there was anything a mother could do with a teenage daughter except hope that some basic values had been learned), Monique changed to the more personal "tu" form in talking to him. This established an additional intimacy between them that deepened in the wee hours of the morning.

Monique talked about Paris, about the romance of the streets, the bistros, the museums, the history. Nick visualized it all and felt transported with her to the city of lights. She told about her dreams when she was growing up, about walking in the sixteenth arrondissement among the wealthy and promising herself that someday . . . He listened closely, enraptured, an almost beatific smile upon his face. In the end, Monique had to tell him that it was time to go because she had an early tennis lesson in the morning. It was after three o'clock. He apologized as they walked together to the door. She laughed and said that it had been fun. At the door she reached up and kissed him on the cheek. His heart soared out of his body at the touch of her lips. "Call me sometime," she said with a playful smile, as she closed the door behind him

For over thirty hours Nick thought of nothing but Monique. He talked to her in his mind during the day; she was his lover in dreams at night. He called her once, twice, three times, each time talking to her answering machine. The third time he left her his phone number and address and suggested that she try to get in touch with him when her schedule would permit.

By noon on the second day after his evening at the Silvers' Palm Beach mansion, he started to calm down, to realize that there was no sense in his continuing to worship the image of a woman he had met for a single evening. Especially a woman who was married to someone else. In the late afternoon he went out on the beach to play volleyball with some of the other college students he had met during his first days in Florida. He had just served an ace when he thought he heard his name being called by a husky, accented voice that was absolutely unmistakable.

He thought for a moment he was dreaming. Standing in the sand not ten yards away was Monique. She was wearing a bright red and white striped bikini and her long black hair hung down her back to just above her waist. The volleyball game stopped. His friends whistled. He walked over to her his heart pounding in his temples and his breath struggling to find its way out of his constricted chest. Monique smiled and slid her arm through his. She explained that she had brought Teresa into Lauderdale for a small high school party and since it was so hot . . .

They walked along, the beach and talked as the sun set behind the condominiums. They were oblivious to the young people all around them. The gentle waves washed their feet with warm water as they walked. Monique insisted that they eat in Nick's condo, so they stopped for tuna fish, tomatoes, onions, and mayonnaise to put on their sandwiches. Cold beer, potato chips, and sandwiches on a bare formica table was the dinner. Lovemaking was the dessert. Nick almost had an orgasm on their first kiss and his passion made him klutzy and funny in trying to remove her bikini. Monique slowed him down, smiled softly, neatly folded her bikini and his bathing suit (while he of course was going wild), and then came to join him on the bed. After two kisses naked on the bed, Nick was seized by a paroxysm of lust. He rolled roughly on top of Monique and began gyrating with his hips. At first a bit alarmed, Monique slowed him just a bit and guided him gently into her.

Monique's body was nearly perfect. Nice, full, upright breasts (they had been reconstructed of course after she had nursed Teresa but how could Nick have known or cared?) slim waist, rounded, feminine ass (not one of those boyish asses that really skinny women have), taut muscled legs kept in shape with lots of exercise. But it was her skin, that magnificent ivory skin, that sent Nick into ecstasy. It was so soft and easy to the touch.

Her mouth seemed to fit his perfectly. Nick had been with two women before, a high-priced call girl given to him as a Christmas present after the Harvard swimming team had discovered he was still a virgin at the end of his freshman year and Jennifer Barnes from Radcliffe, his sometimes steady date during most of his sophomore year. Jennifer's teeth always clanged against his when they kissed. But that had not been the only difficulty in his relationship with Jennifer. She was a physicist and her approach to sex had been almost clinical. She measured sizes and durations and frequencies and even quantities of ejaculant. After three "scheduled performances" with Jenny Nick had decided it wasn't worth it.

Nick gasped as he slid into Monique. Both of them knew it would be over soon. Ten seconds later Nick finished his climax and started to withdraw. But Monique held his rear firmly in her hands, keeping him in place, and deftly (how did she do it?) rolled over so that she was on top. Nick was now out of his element. In his limited experience, withdrawal was the next step after orgasm. He didn't know what Monique was doing. Ever so slowly, her eyes half closed as she hummed a piece of classical music to herself, Monique rocked back and forth on top of him, her vaginal walls holding tightly to his now flaccid penis. After a couple of minutes she began to grind her pelvis forward as she rocked and, much to Nick's amazement, as her breath shortened he found himself becoming aroused again. Now her eyes closed altogether and her rhythm became stronger, the thrusts of her forward motion grinding with a little pain into his bones. Nick was now definitely erect and he started following her motion, lightly gyrating in pattern with her.

Monique leaned forward, concentrating but smiling with her eyes closed, preparing for her own orgasm. She was acutely aware and delighted that Nick was up again. Timing her own progress perfectly (and in complete control of the situation), she adroitly and softly reached down and began titillating Nick's nipples in rhythm with her forward thrusts. Nick had never had his breasts touched in lovemaking before and was shocked. But the raw excitement was overwhelming. She increased her play, even pinching him when she saw (and felt) his response. As wave after wave of delightful release coursed through her body, Nick uttered a loud, wailing scream and had his second orgasm in fifteen minutes. At the end of the climax he was completely given over to pleasure and made animal sounds and shook involuntarily from exhausted satiety.

Nick was a little embarrassed by his noisy and uncontrolled response, but Monique's playful and friendly afterplay assured him that everything was all right. She went to his closet, pulled out one of his three dress shirts, and

put it on. The tails came almost down to her knees (Monique was only five feet five and Nick was a shade less than six two) and she looked positively gamine with her pixie smile, long hair, and man's shirt. Nick began to declare his love but Monique came forward and put her finger to his lips. Then she kissed him lovingly, told him that she needed to pick up Teresa, jumped in the shower for what could not have been more than a minute, dressed, kissed him again, and walked out the door. Nick did not move during this entire time. After she left he fell asleep contentedly. He did not dream.

For the next eight days Nick was on top of the world. He saw Monique every day, most of the time at her Palm Beach mansion, but sometimes at his uncle's condominium. They made love at every opportunity and it was always different. Monique was full of surprises. The second time Nick went to her house, for example, he found her in the back, swimming naked in the pool. She told him that she had given all the servants the day off. Within minutes they were frolicking and laughing on the grass between the garden and the pool.

Their affair was conducted in French. Monique taught him about food and wine. They shared their knowledge of French literature. One passionate night they argued about Andre Gide's La Symphonie Pastorale both before and after lovemaking. Monique defended the pastor and laughed at Nick's insistence that the blind Gertrude was "an innocent. " Another evening, when Monique demanded that Nick wear a black Halloween mask and a pair of white leotards throughout their long French dinner, they read Jean Genet's Le Balcon together as a prelude to sex.

The days raced by relentlessly, clothed in the magic of love and intimacy. Once Nick showed up at the mansion and Monique greeted him dressed in an incredible coat, a full-length Alaskan seal fur with indigo fox trim around the collars as well as down the lapels and framing the sleeves from the shoulders to the wrists. The coat was the softest thing Nick had ever touched, even softer than her tantalizing skin. His playful paramour had turned the air conditioning up as high as it would go so that she could wear her favorite coat. She was wearing nothing underneath it. After lovemaking that evening she dressed Nick's naked body in one of her husband's beaver coats, explaining the presence of half a dozen fur coats in Palm Beach with a simple "it's our business and we like to have some things to show our friends and acquaintances in case they are interested."

Nick professed his love with increasing zeal each time they met anew. Monique responded with her usual "je t'aime," but would not reply to Nick's insistent questions about the future. She avoided all questions about her relationship with Mr. Silver, except to say that he was a workaholic and that he stayed in Montreal most of the year. He had bought the place in Palm Beach primarily because Monique did not like the cold and wanted a more active social life than the one they had in Montreal. Monique usually spent the period from Christmas to Easter in Palm Beach; Teresa, who had just finished her spring break from her exclusive private school and had returned to Canada, came down as often as possible so that she could be with her mother.

Monique gave short, terse answers about her present life. But she waxed rhapsodic about her childhood in Paris. She never criticized her husband or complained about her married life. Yet she did tell Nick that her days with him had been the happiest time of her life. She also talked about some of her friends, but Nick never met any of them. They were always alone.

One day she picked him up in her Cadillac and they headed toward Key Largo so that he could do some diving at the Pennekamp Recreation Area. As always, she was wearing her wedding ring. On this particular day Nick had vowed to himself that he would get some answers about the future, and the constant presence of her wedding ring pissed him off. He asked her to remove it. She

politely refused, then grew angry when he pressed her. She pulled the car off the highway in the marshland north of the Keys and stopped the engine

"It is a fact that I am married," she said resolutely, "and taking the ring off is not going to change anything. I am in love with you, without doubt, but you have understood my situation from the beginning. If you cannot deal with it anymore, then perhaps we should just call it quits."

Nick was shocked by her response. The thought of being without her terrified him. He apologized and professed his love. He began kissing her passionately and then jumped in the back seat. He told her that he needed her right then, that moment. She somewhat reluctantly joined him and they had intercourse on the back seat of her Cadillac. Monique was quiet and pensive most of the rest of the day.

On Friday, exactly a week after they had met, Monique took Nick to a tuxedo shop to have him fitted for a black tie dinner with some friends that she was having on Saturday night in her home. So finally he was going to be seen with her. "And," Nick thought, "now she will talk about our future." Nick was supposed to be in Boston on Monday morning and his parents were expecting him Saturday night in Falls Church, but he assured himself that he could drive all day (and all night if necessary, so pumped up was he in his love for Monique) to get to classes on Monday morning.

Nick was full of hope and dreams when he showed up at the Silver mansion on Saturday night. He looked elegant in his summer tux, and the smile with which he greeted Monique at the door could have won a prize. Even with the doorman standing by, he handed her a dozen red roses, gave her a kiss, and told her that he loved her. "Of course you do," she said lightly, "doesn't everybody?" She took him inside and introduced him to the four other people who had also come early as the "young man who saved our Teresa one day in Lauderdale." Then Monique excused herself. It was her fashion, Nick later learned, to ask a few select friends to come early to a party, to greet them in casual attire, and then to return an hour or so later, when everyone had arrived, with a grand entrance. As Monique gracefully walked up the stairs of the mansion, Nick's eyes followed her with an unmistakable look of adoration.

"Isn't she magnificent?" Nick was asked by a relaxed, tanned man of about fifty who offered him a martini. His name was Clayton. "Once I was with her all weekend on their yacht, while Aaron was in Montreal. I thought she had invited me for a little diversion." He laughed. "But I was wrong. She just wanted some company and I could talk about France and Europe. Come with me (he slipped his arm through Nick's) and I'll introduce you to the select group that was invited early today."

Nick was treated with extreme courtesy by the other favored guests, but he was wary of their questions about Monique. He was, after all, a Southern boy, and if there was something to say about their relationship, it was her place to say it. So he answered politely but modestly and didn't elaborate at all.

One of the two women at the bar, who introduced herself as Jane Somebody, said that she was Monica's oldest friend in Palm Beach. (They all called her Monica. It was impossible for Nick to call her anything but Monique. Nick wondered if they could guess what was going on or if Monique had told them.) Jane was in her late thirties, plump and raucous, a heavy drinker and a chain smoker. She had once been fairly attractive but had lived too hard too soon. She was one of those people who touch everybody during a conversation. She made Nick nervous.

The other guests began to arrive. Jane and Clayton (as in Clayton Poindexter III of Newport and Palm Beach. Clayton, when asked by Nick what he did, answered, "NVMS." Nick of course had absolutely no idea what that meant. Clayton laughed. "NVMS — No visible means of support — a term used to cover all bums.") seemed to be acting as hostess and host in Monique's absence. They introduced him to everybody. Nick had three or four martinis and told the

Teresa story at least seven times during the first hour that he was in the Silver mansion.

Nick was becoming fairly spiffed by this time. He sang to himself as he took another martini off the cocktail tray being proffered by one of the servants. The alcohol had buoyed his spirits and made him feel somehow temporarily suave and debonair. Nick was on the patio talking to Monique's "riding partner," a lovely woman in her mid-twenties named Anne, when he heard scattered applause from the living room. "It's Monica," Anne said. "Let's go see."

The grand stairway in the Silvers' colonial mansion rose to a platform maybe six feet above the living room floor and then split, with two different sets of stairs then continuing up to the second floor. Monique was standing on the platform, acknowledging the applause. dressed in a simple navy blue knit dress that seemed form-fitted to her perfect body. The back was cut way down, almost to the bottom of her spectacular hair (she turned around to please the forty or so guests), and, in the front, two thin pieces of cloth ran from her shoulders to her waist, covering each breast adequately but leaving plenty of cleavage to be admired. Entranced by the vision of his queen, Nick cheered lustily, a little too loud, "Bravo. Bravo." Monique seemed not to hear his cheer. She had turned and was looking up the stairs.

It probably took an entire minute for Nick to comprehend the sight he was seeing. A man, a distinguished-looking man in his early fifties, wearing a custom-made tan tuxedo and sporting an amazing sapphire ring on his little finger, came down the staircase and put his arms around Monique's waist. She reached up and kissed him. He smiled and waved at the crowd as they politely applauded. They walked down the stairs together to the living room.

Who is that? Nick thought to himself and even through the gin and the vermouth and all the incredible feelings the answer came back, That is her husband, Aaron. What is he doing here? Why didn't she tell me? And then, following very swiftly, How could she do this to me? I love her and she loves me and there is something very very wrong. This cannot be happening.

Nick tried to breathe but felt as if a large piece of earth-moving machinery were pressed against his chest. Instinctively he turned away from the sight of Monique and Aaron walking down the stairs arm in arm. As he did he spilled part of a martini on Anne's shoulder. His apology was very clumsy. Now completely discombobulated, he stumbled over to the bar, trying desperately to breathe and to stop the pounding in his chest. No. No. She can't be doing this. There must be some mistake. His mind could not read the message that his eyes were transmitting. He drank another martini swiftly, barely aware of his surroundings or the jumbled feelings torturing his soul.

"There he is." He heard her voice behind him, the voice that had come to signify everything that was valuable and important in life, the voice of love. But this time he was terrified. Nick turned and Monique and Aaron were standing right in front of him.

"So finally I get to meet this young man I've heard so much about," he said. Aaron was pleasant, friendly, without a trace of anything but gratitude in his voice. Aaron Silver was holding out his hand. Monique was smiling. God, she's so beautiful. Even now, when I should hate her. Nick mechanically shook Aaron's hand and quietly accepted his thanks for "helping Teresa at a difficult time." Nick said nothing. He turned to look at Monique. She reached up and kissed him on the cheek. Oh those lips. How I long still for those lips. Why? Why? What happens to us now?

Nick suddenly realized that there were tears in his eyes. Ohmygod . I'm going to cry. Embarrassed beyond measure, Nick abruptly excused himself and walked out onto the patio. Now the tears were running down his cheeks. He was afraid he was going to sit down on the grass and start bawling like a baby

Confused, puzzled, he walked around the garden with his head down and tried, without success, to draw a regular breath.

He felt a hand on his elbow. It was Jane, the last person on Earth that Nick wanted to see at this moment. “She’ll be out to see you in a few minutes. First she and Aaron have to make the rounds, you know how it is at parties when you’re the hostess.” Jane lit a cigarette. Nick was certain he was going to puke. He turned quickly to ask her to put out the cigarette and he lost his equilibrium.

Maybe it was the drink, maybe the adrenaline, maybe it was just too much. Nick’s head was spinning around and around. He inadvertently leaned against Jane for support. She misunderstood, and then pulled his head to her shoulder. “There, there,” she said. “Don’t take it so hard. You and Monique will still be able to have some time together. Aaron will only be here for a couple of days and then he’ll go back to Montreal to work. Besides,” she said with gusto, “if you’re anywhere near as good as Monica says you are, I’d be delighted to take care of you when she’s with Aaron.”

Nick pushed her away and staggered back. He felt as if he had just been hit in the face with a sledgehammer. The full impact of Jane’s comment sunk in slowly and an uncontrollable mixture of anger and hurt surged to the surface. What? What? She knows. This cloying bitch knows. Maybe they all know. What? Fuck. Fuck this altogether. And then, almost immediately, as his mind began to take the measure of the evening’s events, How do I get out of here? Where is the exit? As he walked around the house to the front (he was not about to go inside again), from deep inside Nick there now came a sound, a sound that welled up to the surface and could not be contained. This was the wail of pain, the unmitigated and ineluctable cry of the animal in total despair. Millennia of acculturation have made it rare to hear such cries from human beings. But this loud and untoward scream, which rose into the Palm Beach night like a siren from a police car, gave Nick his first comfort. While the partygoers were trying to decide what they had heard, Nick climbed into his 1977 Pontiac and drove away.

He drove south toward Fort Lauderdale, his heart still pumping like crazy and his body trembling from adrenaline. He didn’t think about anything coherently. The pictures in his mind seemed to come at random, without any clear connection between them. Monique was the focus of all the pictures in the montage. Monique in her Alaskan seal coat, Monique in her red and white bathing suit, Monique in her dress tonight (Nick winced, for just off-screen left in his mind’s eye, he could see Aaron coming down the stairs). Had it all been meaningless? Was it just a game? Nick was too young to know about the grays of life. For him it was a simple question of black or white. It was either wonderful or it was shit. Monique either loved him passionately and wanted to give up her luxurious life to marry him, or she was just using him to satisfy her sexual needs and her ego. So, he concluded, as he arrived at his uncle’s condominium in Fort Lauderdale, I was another of her toys. I was like her furs and horses and yachts and clothes. I made her feel good.

Disgusted with himself, depressed beyond belief, a headache starting to tear his brain apart from the martinis, Nick rapidly packed his clothes. He didn’t bathe or eat. He took his two suitcases down to the car, left the rented tuxedo with the managers of the complex, and drove out toward Interstate 95. A couple of miles before he reached the freeway, Nick pulled the car off on the shoulder and allowed himself a few tears. That was all. The external hardness that would characterize the next ten years of his life began at that moment. Never again, he said to himself. I will never again let some bitch make a fool of me. No way, Jose`.

Ten years later, early on a March morning in his condominium in Key West, Nick Williams would idly play with a metallic golden object sitting on his coffee table and experience again the terrible pain of seeing Monique with her husband at that party. Wistfully, with some mature chagrin, he would remember

also how, when he reached 1-95, he turned left and south toward Miami and the Keys instead of right and north toward Boston. He couldn't have explained why at the time. He might have said that Harvard was trivial after Monique or that he wanted to study life and not books. He didn't understand that his need to start absolutely fresh came from the fact that he could not face himself.

He had not played the memory of Monique through from start to finish for five years. This morning, for the first time, Nick had been able to distance himself from the recalled emotions, ever so slightly, and to see the entire affair with a tiny bit of perspective. He recognized that his blind youthful passion had set him up for the anguish, but he was still reluctant to find Monique faultless. At least the memory no longer destroyed him. He picked up the trident and walked to the window. Maybe it's all coming together now, he said to himself. A new treasure. A final molting of the last adolescent angst. He thought about Carol Dawson. She was vexing but her intensity fascinated him. Always the dreamer, Nick visualized Carol in his arms and imagined the warmth and softness of her kiss.

3

CAROL watched in fascination as the octopus captured its prey with its long tentacles. "Imagine what it would be like to have eight arms," Oscar Burcham said. "Just think of the brain architecture necessary to separate all the inputs, to identify which stimulus was coming from which limb, to coordinate all the tentacles in defense or acquisition of food."

Carol laughed and turned to her companion. They were standing in front of a large. translucent glass window inside a dimly lit building. "Oh, Oscar," she said to the old man with the bright eyes, "you never change. Only you can think of all these living creatures as biological systems with architectures. Don't you ever wonder about their feelings, their dreams while they are sleeping, their concepts of death?"

"Aye, well I do," Oscar replied with a twinkle in his eye. "But it's virtually impossible for human beings, even with a common language and developed communications skills, to truly describe their feelings. How could we even know or appreciate, for example, a dolphin's sense of loneliness? In our maudlin way we ascribe to them human emotions, which is ridiculous." He paused for a moment to think. "No," he continued, "it's more fruitful to conduct scientific inquiry at levels where we can understand the answers. In the long run, I believe that knowing how these creatures function, in the scientific sense, is more likely to lead us to their emotional quotients than conducting psychological experiments whose outcomes cannot be interpreted."

Carol reached over and kissed him fondly. "You take everything I say so seriously, Oscar. Even when I'm kidding, you always pay attention to my comments." She stopped and looked away. "You're the only one who does."

Oscar pulled back dramatically and put both his hands on Carol's right shoulder. "Somewhere here there's a chip . . . I know it for a fact . . . It's almost always here . . . Ah, I found it." He looked at her knowingly. "It's not becoming, you know. Here you are, a successful, even celebrated reporter, still suffering from what could only be described as terminal insecurity. What's this about? Did you and the boss have a big fight this morning?"

"No," Carol replied, as they walked across the room to another part of the aquarium. "Well, sort of I guess. You know how he is. He takes over everything. I'm working on this big story down in Key West. Dale comes to the airport to pick me up, takes me out to breakfast, and proceeds to tell me exactly what I should be doing to cover my assignment. His suggestions are

almost all good, and I appreciate his help on the technical issues, but it's the way he talks to me. As if he thinks I'm stupid or something."

Oscar looked at her intently. "Carol, my dear, he talks to everybody that way, including me. He doesn't mean anything by it. He is absolutely convinced of his own superiority and nothing has ever happened in his life to change his mind. He was a millionaire from his own patents before he graduated from MIT."

Carol was impatient and frustrated. "I know all that, Oscar, believe me, I know. But you're protecting him again. Dale and I have been lovers for almost a year. He tells everybody how proud of me he is, how much he enjoys being stimulated by my mind. But when we're together, he treats me like a fool. This morning he even argued with me about what I was having for breakfast. For Christ's sake, I've been nominated for a Pulitzer Prize but the guy who wants to marry me doesn't think I can order my own breakfast."

They were standing in front of a large tank with crystal-clear water. About half a dozen small whales were swimming in circles around the tank, occasionally going to the surface for air. "You came and asked my opinion in the beginning, my young friend," he said quietly. "And I told you that I thought your souls were not compatible. Do you remember what you said to me?"

"Yes," she answered with a rueful smile. "I asked you what the chief scientist of MOI could possibly know about souls. I'm sorry, Oscar. I was sorry at the time. I was so headstrong. Dale looked great on paper and I wanted your approval — "

"Forget it," he interrupted her. "You know how I feel about you. But never underestimate a scientist. Some of them," he said abstractedly, "want to know facts and concepts so that ultimately they can understand the overall nature of everything. Including the putative soul.

"Now take these whales," Oscar continued, increasing the tempo and adroitly changing the subject. "We have been mapping their brains for almost a decade now, isolating various kinds of functions in specific locations, and trying to correlate their brain structure with that of a human being. We have been reasonably successful. The language function that governs their singing has been separated and the location of the physical controls for all parts of the body have been identified. In fact, we have found an area in the whale brain that corresponds to the equivalent function for every major capability in the human brain. But there's still a problem, a mystery if you will."

One of the whales stopped in its normal circuit about the tank. It seemed to be watching them. "There's a large section of their brain that we have been unable to allocate to any specific function. A brilliant scientist years ago, after listening to the whales' songs while they were migrating and correlating those songs with the rest of their behavior, postulated that this large, unmapped portion of their brain was a multidimensional memory array. His hypothesis was that the whales store entire incidents in that array, including sights, sounds, and even feelings, and that they relive these incidents during migration to alleviate the boredom. Our tests are starting to confirm his theory."

Carol was intrigued. "You mean, they might put in that array the entire set of sensory impressions from something important, like calving, and then have, in a sense, a full instant replay during a particularly boring part of the migration route? Wow. That's fascinating. My memory irritates me all the time. It would be great if somehow I could go in there, in a directed sense, and pull out anything I want. Complete with feelings." She laughed. "There have been times in the summers when I couldn't remember exactly how great it felt to ski and I have almost panicked, worrying about whether or not that feeling might be gone the next winter."

Oscar waved at the whale and it swam away. "Be careful," he said. "Other people have also thought that it would be fantastic if our memories were more complete, like a computer's. But suppose we did have a perfect,

multidimensional memory like that hypothesized for the whale. And suppose we had the same lack of entry control that is characteristic of human memory as it now exists. You know, where what we remember and when we remember it are not under our individual control. Then there would be problems. We might even be nonfunctional as a species. A song, a picture, a smell, even the taste of a cake might suddenly force us to confront anew the full emotions associated with the death of a loved one. We might have to see again a painful fight between our parents. Or even the trauma of our own birth."

Oscar was quiet for a moment. "No," he said finally, "evolution has served us in good stead. It couldn't develop an entry control mechanism for our memories. So to protect us, to keep us from being demolished by mistakes or past events, evolution built a natural fade process into our memories — "

"Carol Dawson. Carol Dawson. Report immediately to the audiovisual conference room adjacent to the director's office."

The loudspeaker interrupted the quiet in the MOI aquarium. Carol gave Oscar a hug. "It's been great, Ozzie, as always," she said, watching him wince as she used her pet name for him. "But it looks like they've finished developing the pictures. Incidentally, I think the whole business about the whales' memories is fascinating. I want to come back and do a feature on it Maybe next week sometime. Give my love to your daughter and grandson."

Carol had become so engrossed in the discussion with Oscar that she had momentarily forgotten why she had flown to Miami early that morning. Now she felt anew a keen sense of excitement as she drove back to the main MOI administrative building from the aquarium. Dale had been confident at breakfast that processing the infrared images would reveal something of interest. "After all," he had said logically, "the foreign object alarm was triggered repeatedly And nothing could be seen in the visual images. Therefore, either the infrared observations caused the alarm or the algorithm did not work properly. The second possibility is very unlikely, since I designed the data flow myself and my best programmers tested it after it was coded."

Dale was uncharacteristically excited when she walked into the conference room. Carol started to ask him a question but was silenced by a vigorous negative motion of the head that followed his smile of greeting. Dale was talking to two of the image-processing technicians. "Okay, then, we're squared away? Display the images in this sequence. I'll call for each one by using the pickle." The technicians left the room.

Dale came over and grabbed Carol. "You are not going to believe this," he said, "what a bonanza. What a fucking bonanza!" He settled down a little. "But first things first. I promised myself that I would not spoil it for you. "He showed her to a seat at the conference table in front of the large screen and then sat down beside her.

He pushed the remote-control switch. Up on the large screen came a still frame of the three whales in the reef area under the boat. The fissure could clearly be seen to the right and beneath the whales. Dale looked at Carol. "I see," she shrugged, "but what's the deal? I took pictures with my underwater camera that are just as good."

Dale turned back to the screen and pushed thc remote several more times. The successive scenes zoomed in on the hole in the coral reef, eventually isolating and centering on a small glint in the lower left side of the fissure. Again Dale looked at Carol. "I have a similar blowup," she said pensively. "But it's impossible to tell if something is really there or if it's an artifact of the photographic process. "She stopped herself. "Although the fact that two distinctly different techniques found the light in essentially the same place suggests that it might not be a processing distortion." She leaned forward, interested. "So what's next?"

There was no way he could contain himself Dale jumped up and started pacing around the room. "What's next," he began, "could be your ticket to the

Pulitzer dinner in New York. Now I am going to show you exactly the same sequence of images, only these were taken in the infrared a fraction of a second later. Watch closely, especially in the center of the fissure."

The first processed infrared image covered the same area underneath the boat that the first visual image had shown. In the infrared picture, however, what was shown were thermal variations in the scene. In the processing, each pixel (an individual picture element in the image) was given a specific temperature based on the infrared radiation observed from that portion of the frame. Similar temperatures were then grouped together by the computer processing and assigned the same color. This process created isothermal regions, or regions of roughly the same temperature, that were visually connected by color. The result was that in the first picture the whales stood out in red, most of the reef plants were blue, and the normalized water temperature formed a dusky gray background. It took Carol a moment to adjust to the display. Dale was smiling triumphantly. Before Carol had a chance to focus on two small regions, one red and another brown down in the center of the hole in the reef, the zoom process had begun. In a few seconds an infrared close-up of the fissure clearly demonstrated why Dale was so excited.

"I told you there was something under the boat," he said, walking to the screen and pointing at a brown, elongated object. The object was cylindrical at one end and tapered to a point at the other. The fissure had been blown up by the zoom process so that it almost completely filled the screen. Even with all the magnification, the quality of the infrared image was superb. Inside the opening three or four different colors could be seen; however, only two, the brown and the red, were continuous over a significant number of pixels

"Holy shit," said Carol, involuntarily rising from her seat and walking over to join Dale, "that brown thing must be the lost missile. It was underneath us all the time. " She picked up the pointer and waved it at the screen. "But what's this red area? It looks like the Cheshire cat from Alice in Wonderland."

"I'm not absolutely certain," Dale replied, "and it's probably not anything of major significance. But I do have a crazy idea. Actually it's based on what you told me about the strange behavior of the whales down there. It may be the head of another whale, back away from the light, looking out of the cave. Or whatever the opening is. Here, look at this. By zooming out a little we obtain one single picture that shows both of the red isothermal regions. Look how the red region in the middle of the fissure and the red from your sentinel whales look the same. Even with additional stretching, the two regions remain comparable in temperature. Not a proof of any kind, but it certainly supports my proposition."

Carol's mind was racing ahead. She was already planning her next move. It was essential that she retrieve that missile before anybody knew it was there. She needed to return to Key West as soon as possible. She picked up her purse and her briefcase. "Can someone drive me to the airport, please, Dale? Right now. I want to call that Lieutenant Todd again and scare him a bit. You know, make him a little more cautious and buy some time for us."

She paused, thinking of a million things at once. "But I can't call him from here without making him suspicious . . . And I must make some arrangements for a boat for tomorrow . . . Oh, incidentally, I assume you have hard copy of those pictures available for me."

Dale nodded his head. "I do," he said. "But first sit down and relax for a second. I want to show you something else. I don't yet know if it's a real phenomenon, but if it is . . ." Carol started to protest but there was something in his manner that told her to acquiesce. She sat down. He launched into a discussion of enhancement algorithms, explaining how the information in pictures could be stretched to highlight special features and allow easier interpretation.

“Okay, Okay,” she said at length. “The bottom line is what I need. I know already how clever you and your engineers are.”

Dale put the first infrared image back on the screen, the one that showed the full view of the three whales underneath the boat. “This picture does not have much thermal granularity. Every pixel in the region colored red, for example, does not correspond to exactly the same temperature. In reality, the spread in temperatures for the same color is roughly five degrees. Now if we stretch the image, and make the isothermal regions only cover a total spread of two degrees each, we obtain this picture.”

In the new image there were ten different colors. It was much harder to see individual features, and spurious data points made the picture extremely difficult to interpret. A portion of the front of one of the whales was now a different color from the rest of the animal.

“The limit of accuracy of the equipment, by the time the raw spectral data is converted to temperatures, is about one degree. If we show another stretch of the same picture, with the connected isothermal regions now only covering a total range of one degree each, then the picture almost becomes gibberish. Now there are twenty different colors for the isothermal regions and, because the noise or error in each data point is of the same magnitude as the spread in the isothermal region, it is virtually impossible to see the figures of known objects like the three whales. I tell you all this up front to make certain you realize that what I am about to show you may be completely wrong. It is, nevertheless, absolutely fascinating.”

The next image projected on the screen was a close-up down on the floor of the ocean, just above the trench that Carol had followed when backtracking to find the origin of the tracks. The familiar parallel lines just barely showed up in the infrared image The fissure was almost off the left side of the image. On either side of the trench, blue color broken with some occasional green marked the two reefs. Carol looked at Dale with a puzzled expression on her face.

“This close-up has the same five-degree granularity as the big reference image. There is nothing of note here.” He flashed another picture. “Nor here, where we have increased the number of colors to ten again. But look at this.” One more image went up on the screen. The picture was very difficult to follow, much less interpret. As many as twenty different colors connected odd regions in what appeared to be random patterns. About the only thing that was regular in the picture were the background rocks on which the coral and other sea life were living. And it was those background rocks that had Dale so excited.

“This is what I wanted you to see,” he said, waving his hand at the rocks on the two sides of the trench. “The two reef structures do not have the same color. For some unknown and absolutely inexplicable reason, every background rock area on this reef is coded chartreuse. On the opposite reef, just across the trench a few feet away, all the background rock is yellow. A one-degree difference. Now if some of the yellow pieces were interspersed with the chartreuse, and vice versa, then I would say that the data clearly has no significance and that what we are seeing are noise signatures. But this pattern is compelling.”

Carol was lost. She could see that the rocks on one reef structure were all chartreuse and that the opposite reef was yellow. But it didn’t mean anything to her. She shook her head. She needed more explanation.

“Don’t you understand?” Dale said with a final dramatic flourish. “If this data is right, then we have found something else of great importance. Either there is some source inside one of the reef structures that is making its surface uniformly warmer, or, and I admit this sounds truly incredible, one of the two is not a reef at all and is something else masquerading as a reef.”

IT was almost always impossible to find a parking place in the middle of the working day near Amanda Winchester's house in Key West. The Hemingway Marina had revitalized the old part of the city where she lived, but as usual everyone had underestimated the need for parking. All the repainted and renovated nineteenth-century mansions along Eaton and Caroline streets had signs on the street saying such things as DON'T EVEN THINK ABOUT PARKING HERE IF YOU'RE NOT A RESIDENT, but it was no use. People who worked in the retail shops around the marina parked where it was convenient for them and avoided the heavy parking fee at the marina lot.

After searching fruitlessly for a parking place for fifteen minutes, Nick Williams decided to park outside of a convenience store and walk the block or so to Amanda's house. He was strangely anxious. Part of his nervousness was due to his excitement, but he was also feeling a little guilty. Amanda had been the major sponsor of the original Santa Rosa expedition and Nick had spent considerable time with her after they had found the treasure. Amanda and Nick and Jake Lewis had all three believed that Homer Ashford and his menage a` trois had somehow hidden part of the treasure and then cheated them out of their proper shares. Nick and Amanda worked together trying to find evidence that Homer had stolen from them, but they were never able to prove anything conclusively.

During this period Amanda and Nick had become quite close. They had seen each other virtually every week and for a while he had thought of her as an aunt or grandmother. But after a year or so, Nick had stopped going by to visit her. He hadn't understood it at the time, but the real reason he began to avoid her was that Amanda was too intense for him. And she was always too personal. She asked him too many hard questions about what he was doing with his life.

On this particular morning he had no real options. Amanda was widely recognized as the expert on sunken treasure in the Keys. There were two components in her life, treasure and the theater, and her knowledge of each was encyclopedic. Nick had not called first because he didn't want to discuss the trident unless she was willing to see him. So it was with some trepidation that he rang the doorbell on the front porch of her magnificent home.

A young woman in her early twenties came to the door and opened it just a bit. "Yes?" she said, her face wedging into the crack, her expression wary.

"My name's Nick Williams," he said. "I would like to see Mrs. Winchester if possible. Is she in?" There was a pause. "I'm an old — "

"My grandmother is very busy this morning," the girl curtly interrupted him. "Perhaps you can call and make an appointment." She started to close the door and leave Nick standing on the porch next to his exercise bag. Then Nick heard another voice, a muffled exchange, and the door swung open.

"Well, for goodness sake," Amanda said with her arms outstretched, "I have a young gentleman caller. Come here, Nikki, and give me a kiss." Nick was embarrassed. He walked forward and gave the elderly woman a perfunctory hug.

As he withdrew from the embrace, he started to apologize. "I'm sorry I haven't been by to see you. I mean to, but somehow my schedule — "

"It's all right, Nikki, I understand." Amanda interrupted him pleasantly. Her eyes were so sharp they belied her age. "Come in and tell me what you've been up to. I haven't seen you since, goodness, has it been a couple of years already since we shared that cognac after Streetcar?" She led him into a combination study and living room and sat him down next to her on the couch. "You know, Nikki, I thought your comments about the actress playing Blanche DuBois were the most observant ones I heard during the entire run. You were right about her. She couldn't have played Blanche except as a total mental case. The woman simply had no concept of a feminine sexual appetite."

Nick looked around him. The room had hardly changed in the eight years since he had last visited it. The ceiling was very high, maybe fifteen feet. The walls were lined with bookcases whose full shelves extended all the way to the ceiling. Opposite the door a huge canvas painting of Amanda and her husband standing outside their home on Cape Cod dominated the room. A new 1955 Ford was partially visible in the background of the painting. She was radiantly beautiful in the picture, in her early thirties, dressed in a white evening gown with daring red trim both around the wrists and along the collar of the neck. Her husband was in a black tux. He was mostly bald, with short blond hair graying at the temples. His eyes were warm and kindly.

Amanda asked Nick if he wanted tea and he nodded. The granddaughter Jennifer disappeared into the hallway. Amanda turned and took Nick's hands in hers. "I am glad you came, Nikki, I have missed you. From time to time I hear a snippet here or there about you or your boat, but often second-hand information is altogether wrong. What have you been doing? Still reading all the time? Do you have a girlfriend?"

Nick laughed. Amanda had not changed. She had never been one for small talk. "No girlfriend," Nick said, "same problem as always. The ones that are intelligent turn out to be either arrogant or emotionally inept or both; the ones that are sensitive and affectionate have never read a book. "For some reason Carol Dawson jumped into Nick's mind and he almost said, without thinking, "except for, maybe," but he stopped himself. "What I need," he said instead, "is someone like you."

"No, Nikki," Amanda replied, suddenly serious. She folded her hands in her lap and stared momentarily across the room. "No," she repeated softly, her voice then gathering intensity as she turned back to look at him, "even I am not perfect enough for you. I remember well all your fantasy visions of gracious young goddesses. Somehow you had mixed the best parts of all the women in your favorite novels together with your teenage dreams. It always seemed to me that you had put women up on a pedestal; they had to be queens or princesses. But in the girls you actually dated, you looked for weaknesses, signs of ordinariness, and indications of common behavior. It was almost as if you were hoping to find them imperfect, to detect chinks in their armor so that you could justify your lack of interest."

Jennifer arrived with the tea. Nick was uncomfortable. He had forgotten what it was like to talk to Amanda. Her emotional probing and her unsolicited observations were both extremely disquieting to him this morning. Nick had not come to see her to dissect his attitude toward women. He changed the subject

"Speaking of treasure," he said, bending down to pick up his bag, "I found something very interesting yesterday while I was out diving. I thought maybe you might have seen something like it before." He pulled the trident out and handed it to Amanda. She almost dropped it because she was not prepared for its weight.

"Goodness," she said, her skinny arm trembling under the strain of holding the golden trident out in front of her. "What could it possibly be made from? It's too heavy to be gold!"

Nick leaned forward and took the object. He held it for her as she ran her fingers over its exceptionally smooth exterior. "I've never seen anything like this, Nikki. I don't need to get out all the books and the photographs for comparison. The smoothness of the finish is inconsistent with the processing techniques in Europe during or after the galleon days. This must be modern. But I can't tell you anything else. Where in the world did you find it?"

He told her just the outline of the story, careful as always not to give away key bits of information. It was not just the agreement he had made with Carol and Troy; treasure hunters never really trust anybody. But he did share with Amanda his idea that perhaps someone had cached this particular piece, as

well as some others, for later retrieval. Nick insisted that this idea of his was a perfectly plausible explanation for the tracks on the ocean floor.

"Your scenario seems very unlikely to me," Amanda said, "although I must admit that I am baffled and have no better explanation. Maybe Miss Dawson has some sources that can shed some light on the origin of this thing. But there is almost no chance that I am mistaken. I have personally seen or viewed close-up photographs of every significant piece of treasure recovered from the Keys in the past century. You could show me a new piece today and I could probably tell you in what European country it was made and in what decade. If this object comes from a sunken ship, it is a modern ship, almost certainly after World War II. Beyond that I can't help you."

Nick put the trident back in the bag and started to leave. "Wait just a minute before you go, Nikki," Amanda said as he stood up. "Come over here for a minute." She took him by the arm and led him over to a spot just in front of the large painting. "You would have liked Walter, Nikki. He was a dreamer also. He loved to look for treasure. Every year we would spend a week or two in the Caribbean on a yacht, ostensibly looking for treasure but just generally sharing each other's dreams. From time to time we would find objects on the bottom of the ocean that we couldn't understand and we would create fanciful conjectures to explain them. Almost always there was some prosaic explanation that was inferior to our fantasies."

Nick was standing beside her with his bag in his right hand. Amanda turned to him and put her hand softly on his left forearm. "But it didn't matter. It didn't even matter that most of the years we came up empty-handed altogether. For we always found the real treasure, our love for each other. We always returned home renewed and laughing and thankful that life had allowed us to share another week or ten days in which we had imagined and fantasized and hunted for treasure together."

Her eyes were soft and loving. Her voice was low but full of passion. "I do not know when or if you will come again, Nikki, but there are some things that I have been wanting to say to you for some time. If you like, you can dismiss them as the ravings of a sententious old woman, but I may never have a chance to tell you these things again. You have all the attributes I loved in Walter, intelligence, imagination, sensitivity. But something is wrong. You are alone. By choice. Your dreams of treasure, your zest for life — you do not share these things. It is very sad for me to see this." She stopped for a second and looked back at the painting. Then she completed her thought, almost as if she were talking to herself. "For when you are seventy years old and look back at what your life has meant, you will not focus on your solo activities. What you will remember are the incidents of touching, those times when your life was enriched by a moment of sharing with a friend or loved one. It is our mutual awareness of this miracle called life that allows us to accept our mortality."

Nick had not been prepared for an emotional encounter with Amanda. He had thought that he would stop by to see her for a few moments, ask her about the trident, and then depart. In retrospect he realized that he had treated Amanda very callously over the years. She had offered genuine friendship and he had spurned it, taking her out of his life altogether when their interaction no longer suited him. He winced as he recognized how selfish he had been.

As he walked slowly down the street, idly looking at the gracious old houses built over a hundred years ago, Nick took a deep breath. He had experienced too many emotions for one morning. First Monique, then Amanda. And it looks as if the trident is not going to solve all my problems. Funny how things always come in groups.

He found himself musing that maybe there had been a lot of truth in what Amanda had said. He acknowledged that he had been feeling lonely lately. And

he wondered if the vague loneliness was indeed coupled to a creeping awareness of his own mortality, to the passage of that phase of life enshrined by Thomas Wolfe with the phrase, “For we were young, and we knew that we could never die.” Nick was feeling very tired when he came to the end of the sidewalk and turned onto the pavement of the convenience store parking lot.

He saw her before she saw him. She was standing next to the driver’s side of her brand-new red Mercedes sports coupe. She had a small brown paper hag in her arm and was looking in the window of the car next to hers, Nick’s 1990 Pontiac Nick felt a quick rush of adrenaline followed by anger and distrust. She finally saw him just as he started to speak. “Why, Greta, what a surprise! I guess we just happened to be in this part of Key West today at exactly the same time.”

“Ya, Nick, I thought it was your car. How are you?” Greta put the paper bag on the hood of her car and approached him in a friendly manner. She had either missed or was ignoring the sarcasm in his greeting. She was wearing a sleeveless yellow tank top and a pair of tight blue shorts. Her blonde hair was pulled back in two short pigtails.

“Don’t play innocent with me, fraulein,” Nick overreacted. “I know you didn’t come here to shop. “ He was nearly shouting. He used his free arm to accentuate his comments and block Greta’s approach. “This is not one of the stops on your circuit. You came here to find me. Now what do you want?” Nick dropped his arm. A couple of passersby had stopped to watch the exchange.

Greta stared at him for a moment with those crystal-clear eyes. She was wearing no makeup. She looked like a little girl except for the wrinkles on her face. “Are you still so angry, Nick? After all these years?” She came up next to him and smiled knowingly into his eyes. “I remember one night, almost five years ago,” she said playfully, “when you were not so angry. You were glad to see me. You asked me if I would have you for one night, no questions asked, and I agreed. You were great.”

In a momentary flash Nick remembered the rainy night when he had stopped Greta just as she was leaving the pier. He recalled also how desperately he had needed to touch someone, anyone, on that particular night. “That was the day after my father’s funeral,” he said roughly, “and didn’t mean shit anyway.” He looked away. He did not want to return her piercing gaze.

“That wasn’t the impression I had,” Greta continued in the same playful but otherwise emotionless tone. “I felt you inside me, I tasted your kisses. You can’t tell me — ”

“Look,” interrupted Nick, clearly irritated. “What do you want? I don’t want to stand here all morning arguing with you about some stupid night five years ago. Now I know that you’re here for a reason. What is it?”

Greta backed off a step and her face hardened. “You are a very difficult man, Nick. It could be such fun doing business together if you weren’t such a, how do you say, pain in the ass.” She stopped for a moment. “I have come from Homer. He has a proposition for you. He wants to see what you found yesterday in the ocean and maybe discuss a partnership.”

Nick laughed triumphantly. “So I was right all along. You were sent to find me. And now that bastard wants to discuss a partnership. Hah. Not a fucking chance. You won’t steal from me again. Tell your employer or lover or whatever he is to cram his proposition up his ass. Now if you’ll excuse me . . .”

He started to walk around Greta and open his car door. Her strong hand grabbed his forearm. “You’re making a mistake, Nick.” Her eyes bored into his again. “A big mistake. You can’t afford to do it on your own. What you found is probably worthless. If it is, let him spend the money.” Her chameleon eyes shifted one more time. “And it would be such fun to work together again.”

Nick climbed into his car and turned on the engine. “No dice, Greta. You’re wasting your time. Now I’ve got to go.” He backed out of the parking

place and then drove into the narrow street. The treasure was front and center in his mind again. He had been momentarily depressed by what Amanda had told him about the trident, but the fact that Homer wanted to see it gave Nick a feeling of power. But, he asked himself, how does he know already? Who talked? Or could someone have seen us?

5

WHEN Commander Winters returned to his office after a scheduled meeting with the public relations department, his secretary, Dora, was conspicuously reading the Key West newspaper. "Ahem," she said, deliberately attracting his attention. "Is the Vernon Winters starring in The Night of the Iguana at the Key West Playhouse tonight anyone I know? Or are there two of them in this town?"

He laughed. He liked Dora. She was almost sixty, black, a grandmother more than a dozen times, and one of the few secretaries on the base who actually had some pride in her work. She treated everybody, including Commander Winters, like one of her children. "So why didn't you tell me?" she said with feigned outrage. "After all, what if I had missed it altogether? I told you last year to make certain that you always told us when you were performing."

He took her hand and gave it a little squeeze. "I had intended to tell you, Dora, but somehow it just slipped my mind. And you know that my thespian activities are not exactly embraced by the Navy, so I don't ballyhoo them about so much. But I'll have some tickets for you and your husband in a couple of weeks." He looked at the stack of message notes on her desk. "That many, huh? And I was only gone a little over two hours. It never rains but it pours."

"Two of these are supposedly urgent." Dora looked at her watch "A Miss Dawson from the Miami Herald will call back in about five minutes and that Lieutenant Todd has been calling all morning. He insists that he must see you before lunch or he can't be properly prepared for the meeting this afternoon. Apparently he left a long, message on your Top Secret telemail sometime this morning. Right now he's furious with me because I wouldn't interrupt your meetings to tell you about his message. Is it really that important?"

Commander Winters shrugged his shoulders and opened the door to his office. I wonder what Todd wants, he thought. I guess I should have checked my telemail before running off to the meeting with the chief. "Did you put all the rest of the messages on the computer?" he asked Dora before he closed the door. She nodded. "Okay, I'll talk to Miss Dawson when she calls. Tell Todd that I will see him in fifteen minutes." He sat down at his desk and turned on his computer. He activated his telemail subdirectory and saw that he had three new entries already this morning, one in the TOP SECRET queue. Commander Winters identified himself, entered the top secret code word, and started to read Lieutenant Todd's transmission.

The phone rang. After a few seconds Dora buzzed him and told him that it was Miss Dawson. Before they started, Commander Winters agreed that the interview could be on the videophone and that it could be taped. He recognized Carol immediately from her occasional appearances on television. She explained to him that she was using the communications facility at the Miami International Airport.

"Commander Winters," she said, wasting no time, "we have an uncorroborated report that the Navy is engaged in a search for something important, and secret, in the Gulf of Mexico between Key West and the Everglades. Your press people and a Lieutenant Todd have both denied the report and referred all questions to you. Our source also told us, and we have subsequently verified both of these facts, that there are today a large number of technology ships sailing in the Gulf and that you have been trying to rent sophisticated ocean telescopes from the Miami Oceanographic Institute. Do you have any comment?"

“Certainly, Miss Dawson.” The commander wore his best acting smile. He had carefully rehearsed the response in his morning meeting with the admiral. “It’s really amazing how rumors fly, particularly when someone suspects the Navy of nefarious deeds. “ He chuckled. “All the activity is just preparation for some routine maneuvers next week. A few of the sailors who man the technology ships are a little rusty and wanted some practice this week. As for the MOI telescopes, we intended to use them in our maneuvers to check their value in assessing underwater threats.” He looked directly at the camera. “That’s it, Miss Dawson. There’s nothing special going on.”

Carol watched the commander on the monitor at the airport. She had expected someone with an imposing air of authority. This man had a softness in his eyes, some kind of sensitivity that was unusual in a career military officer. Carol had a sudden idea. She walked up close to her own camera. “Commander Winters,” she said pleasantly, “let me ask you a hypothetical question. If the Navy were testing a new kind of missile and one test flight went astray, possibly even threatening population centers, wouldn’t it be likely that the Navy, claiming national security reasons as its defense, would deny that such a thing had happened?”

For a fleeting fraction of a second the expression in the eyes of Commander Winters wavered. He looked shocked. Then he regained control. “It is difficult to answer such a hypothetical question,” he intoned formally, “but I can tell you that it is Navy policy to keep the public informed about its activities. Only when the flow of information to the public could significantly undermine our national security would any kind of censorship take place.”

The interview wound up quickly. Carol had accomplished her objective. Damn, said Commander Winters to himself as Dora announced that Lieutenant Todd was waiting to see him. I should have expected that question. But how did she know that? Did she somehow trick Todd or one of the other officers? Or did someone in Washington spill the beans?

Winters opened the door to his office and Lieutenant Todd nearly stormed into the room. With him was another tall young lieutenant, thick shouldered with a bushy mustache whom Todd introduced as Lieutenant Ramirez of the Naval Intelligence Division. “Did you read my telemail message? What did you think? My God, it’s almost unbelievable what those Russians have done. I had no idea they could be so clever.” Todd was almost shouting as he paced excitedly around the office.

Winters watched Todd jumping around the room. This young lieutenant, he thought, is in a big hurry to get somewhere. His impatience is oozing out of every pore. But what in the world is he saying about the Russians? And why is this Mexican muscleman here with him?

“Sit down. please,” the commander replied, motioning at the two chairs opposite his desk. He looked sternly at Lieutenant Todd. “And start by explaining why Lieutenant Ramirez is here. You know the regulations; we were all briefed on them again last week. Only officers at the rank of commander or higher can authorize sharing information on a need-to-know basis.”

Todd immediately defended himself against the reproach. “Commander Winters, sir,” he replied, “I believe that what we have here is a major international incident, far too big to be handled by special projects and systems engineering alone. I left word on your telemail interrupt at 0830 this morning for you to contact me ASAP, that there was a significant new development in the Broken Arrow project. When I had not heard from you by 1000, even though I had tried several additional times to reach you by telephone, I became worried that we might be losing valuable time. I then contacted Ramirez so that he and his men could start their work.”

Todd stood up from his chair. “Sir,” he began again, the excitement rising in his voice, “maybe I didn’t make it clear enough in my telemail message. We have hard evidence that someone commanded the Panther to go astray,

right after the APRS was activated. We have confirmed from a special manual search of the intermittent telemetry data that the command receipt counters went crazy during a two-second period just before the missile veered off course."

"Calm down, Lieutenant Todd, and sit down again. "Winters was irritated, not just by Todd's nonchalant dismissal of the regulations issue, but also by his undisguised accusation that Winters had been delinquent in responding to his messages. The commander's day had begun with a meeting with the admiral who ran the air station. He had wanted a briefing on all this Broken Arrow business. So Winters had not even been in his office, except for a couple of minutes, until after he came back from the public relations department.

When Todd was again seated, Winters continued carefully, "Now spare me the hysteria and your personal conclusions. I want you to give me the facts, only the facts, slowly and without prejudice. The accusations you made a few moments ago are very very serious. In my eyes, if you have jumped to unsubstantiated conclusions too quickly, your fitness as an officer may be in doubt. So start at the beginning."

There was a flash of anger in the lieutenant's eyes and then he opened his notebook. When he spoke, his voice was a monotone, carefully modulated to be free of all emotion. "At precisely 0345 this morning," he began, "I was awakened by Ensign Andrews, who had been working most of the night on the telemetry dumps that we recalled both from the Canaveral station and the tracking ship near Bimini. His assignment had been to go through the scheduled sequence of events onboard the Panther missile and determine, from the scattered telemetry if possible, if any anomalous events had occurred onboard just before the missile went off course. We thought that this way we might have a chance to isolate the cause of the problem.

"Basically Ensign Andrews was a detective As you know, the data system is quite constrained by the limited downlink bandwidth. So the packets of telemetry data come out in a somewhat artificial way, meaning that many of the data values governing the behavior of the bird at the time it changed direction would not have been sent to the Earth until several minutes later, after the missile had gone awry and the tracking stations had already dropped and regained lock a couple of times.

"Ensign Andrews showed me that in the intermittent data there were four discrete measurements taken from the command receipt counter, a simple buffer in the software that increments by one every time a new command message is correctly received by the missile. At first we did not believe what we were seeing. We thought perhaps someone had made an error or that the decommutation maps were wrong. But by 0700 we had both checked the values from the two tracking sites and verified that we were indeed looking at the correct channel. Commander, in the 1.7 seconds after the APRS was activated, the command receipt counter registered over three hundred new messages. And then the missile swerved away from its intended target."

The commander was writing in a small spiral notebook while Todd was talking. It took him almost half a minute to finish his notes. Then he looked up at Todd and Ramirez. "Am I to believe then," he said, his voice heavy with sarcasm, "that this is the entire data set upon which you wish to base your indictment of the Soviet Union and put our Navy intelligence community on alert? Or is there something else?"

Todd looked confused. "You think it's more likely," Commander Winters continued, his voice now rising, "that the Russians knew the code for the command test set and transmitted three hundred messages in less than two seconds, exactly at the right time and from somewhere off the Florida coast, than it is that somewhere in the 4.2 software system there is an error that is improperly incrementing the command receipt counter? My God, Lieutenant, use your head. Are you seeing bogeymen at night? This is 1994. There is virtually no tension on the international scene. You believe that the Russians are so

colossally stupid that they would risk detente to command a Navy cruise missile off course while it is still under test? Even if they could somehow command the missile to a specific location and then recover it and understand it thoroughly by reverse engineering, why would they take such a horrendous chance for such a comparatively small return?"

Todd and Ramirez said nothing during the commander's harangue. Ramirez was starting to look uncomfortably embarrassed toward the end. Todd's boyish self-confidence had faded as well and he began to wring his hands and pop his knuckles absentmindedly. After a long pause Winters continued, firmly but without some of the exasperation of his initial speech.

"We assigned some specific work items yesterday, Lieutenant. They were supposed to be addressed by today. Look again at the 4.2 software, particularly to see if there were any errors in the interface with the command test set that showed up during module or integration testing. Maybe there was a bug in the command receipt counter subroutine that did not get corrected in the new release. And for the meeting this afternoon, I want you to show me a list of possible failure modes that would explain the telemetry data, other than commands being sent from a foreign power. And then show what you are planning to do to analyze each failure mode and reduce the length of the list."

Ramirez stood up to leave. "Under the circumstances, Commander, I feel that my presence here is a little, uh, improper. I have briefed a couple of my men already and have kicked off some investigative work to see if there is now or has been recently any Russian military or civilian activity in the area. I had put a top priority on the effort. In view of this conversation, I feel I should suspend — "

"Not necessarily," Commander Winters interrupted him. "It might be very difficult for you to explain at this juncture." He looked at both of the squirming young lieutenants. "And it is not my wish to be vindictive and put you both on report, although I think you both acted hastily and outside regulations. No, Lieutenant, continue with the intelligence gathering, it may eventually be of some importance. Just don't make a big deal out of it. I'll accept the responsibility."

Ramirez walked toward the door. He was clearly grateful. "Thank you, Commander," he said sincerely, "for a minute there I thought maybe I had crapped in my mess kit. I've learned a very valuable lesson."

Winters saluted the intelligence officer and motioned Todd, who was apparently also preparing to leave, back to his seat. The commander walked over in front of the Renoir painting and appeared to be studying it. He spoke quietly, without turning to face the junior lieutenant. "Did you say anything to that reporter Miss Dawson about a missile, or did she mention a missile to you while you were talking to her?"

"No, sir, there was nothing like that," Todd asserted. "She was even vague when I asked her what she had heard."

"She either has some inside information or is very very lucky," the commander said abstractedly, almost to himself. He walked over closer to the painting and imagined that he could hear the piano being played by the younger of the two sisters. Today he heard a Mozart sonata. But it was not the right time to listen. This young man needs a good lesson out of all this, Winters thought as he turned around.

"Do you smoke. Lieutenant?" he asked, offering Todd a cigarette and placing one in his own mouth. The younger man shook his head. "I do," said Winters, lighting his Pall Mall, "even though there are a thousand reasons why I shouldn't. But I almost never smoke around people who don't. It's a question of consideration."

Winters walked over to look out the window and blew the smoke slowly out his mouth. Todd looked puzzled. "And right now," Winters continued, "I'm smoking, strangely enough, also out of consideration. For you. You see,

Lieutenant Todd," he said, wheeling around dramatically, "I'm calmer after I smoke. That means I can deal better with my anger."

He walked directly over in front of the lieutenant. "Because I'm goddamn mad about this, young man. Make no mistake about that. There's a part of me that wants to make an example of you, maybe even court martial you for not following regulations. You're too cocky, too sure of your own conclusions. You're dangerous. If you had slipped and made some of the comments you made in here to that woman reporter, then it would be Katie bar the door. But" — Winters walked around behind his desk and stubbed out his cigarette, — "it has always been my belief that people should not be crucified for a single mistake."

The commander sat down and leaned back in his chair. "Just between us guys, Lieutenant, you're on probation with me. I don't want to hear any more nonsense about an international incident. This is a simple case of a malfunctioning test missile. Do your job thoroughly and carefully. Don't worry, you'll be noticed if the work is done properly. The system is not blind to your ambition or your talent. But if you run off half-cocked one more time on this problem, I will personally see to it that your personnel file is ruined."

Todd could tell that he was being dismissed. He was still angry, now at himself mostly, but he knew better than to let any of it show. He considered Commander Winters to be a marginally competent old fart, and he hated being lectured by him. As of now, however, I have no choice but to accept it, he said to himself as he left the commander's office.

6

NICK'S message light was blinking when he walked into his townhouse after the meeting with Amanda and the encounter with Greta. He put the bag with the trident back in the closet and turned on the answering machine. Julianne appeared on the small three-inch monitor. Nick smiled to himself. She always left all of his messages, no matter how small, in video.

"Sorry to tell you this, Nick, but your Tampa charter for tomorrow and Sunday just called up to cancel. They said they heard a weather forecast calling for thunderstorms. Anyway, all is not completely lost 'cause you get to keep their deposit." She paused a couple of seconds. "By the way, Linda and Cotinne and I are going to Sloppy Joe's tonight to hear Angie Leatherwood. Why don't you stop by and say hello? I might even buy you a drink."

Shit, said Nick to himself. I needed the money. And Troy did too. He automatically entered Troy's name on the small keyboard near the phone and waited for Troy to pick up the receiver and turn on the video switch.

"Why hello, Professor. What are you doing on such a beautiful day in the tropics?" Troy was in a good humor as usual. Nick could not understand how anyone could be in such a perpetually good mood.

"I have bad news and bad news, my friend," Nick replied. "First, Amanda Winchester says our trident is modern and almost certainly not a part of any ancient treasure. For my part, I'm not completely convinced. But it doesn't look promising. Second, and probably more important for the short term, our charter has cancelled. We have no work for the weekend."

"Ouch," Troy said, a frown sweeping over his face. "That do present some problems." For a moment it seemed that Troy couldn't figure out what to say. Then the normal Troy was back, smiling cheerfully, "Hey, Professor, I have an idea. Since we now both have nothing to do this afternoon, why don't you come over here to the Jefferson sanitarium for some chips and beer? I want to show you something anyway." His eyes were twinkling.

Under almost any circumstances Nick would have declined Troy's offer and spent the afternoon reading Madame Bovary. But the morning had already been

heavy with emotion and Nick was acutely aware that he needed some levity. He smiled to himself. Troy was a very funny man. An afternoon of booze and mirth sounded appealing. Besides, Troy had been working for him for four months and they had not yet taken any time to socialize. Even though they had spent many hours working together on the boat, Nick had never once visited Troy's apartment. "All right," Nick heard himself respond, "you're on. I'll bring the food and you get the beer. I'll see you in twenty to thirty minutes."

When Nick stopped his car in front of the small frame duplex in one of Key West's oldest sections, Troy was just arriving himself. He had apparently walked to a nearby store, for he was carrying a large brown paper bag containing three six-packs of beer. "This ought to hold us for the afternoon." He winked as he greeted Nick and led him up the walkway to his front door. A paper sign was taped to the door. It said, PROF — BE BACK IN A JIFF — TROY. Troy took the sign down and reached up to a small ledge above the door to find a key.

Nick had never wondered what Troy's apartment would be like. But he certainly would not have imagined the living room that he found when he followed Troy inside. The room was laid out neatly and furnished in what could only be called early grandmother style. The motley array of old couches and easy chairs purchased at neighborhood garage sales (none of which was the same color, which was of no importance to Troy — he thought of furniture in terms of functional units, not as pieces of decoration) were arranged in a rectangle with a long wooden coffee table in the middle. An assortment of electronics and video magazines were neatly stacked upon the table. Dominating the room was a state-of-the-art sound system whose four tall speakers were carefully placed in the corners so that all the sound was focused toward the center of the room. As soon as the two men were inside, Troy went over to the compact disc player on thc top of the stereo equipment rack and turned it on. A wonderfully rich, black, female voice backed by a piano and a guitar filled the room.

"This is Angie's new album," Troy said, handing Nick an open beer. He had been to the kitchen and the refrigerator while Nick was looking around the room. "Her agent thinks this one will go gold. Love Letters just barely missed, but she made more than a quarter of a million off it anyway. Not counting the money from the concert tour."

"I remember your telling me that you knew her." Nick said, taking a long drink from his beer. He had walked across the room to a box next to the stereo rack where sixty or seventy discs were neatly arranged. On the front of an open disc jacket on the top of the box was a beautiful young black woman, softly backlit. She was wearing a long dark cocktail dress. Memories of Enchanting Nights was the title of the album. "Is there more to the story of Miss Leatherwood?" Nick said, looking up at Troy. "This is one magnificent lady, if you ask me."

Troy came over beside him. He programmed the disc player to cut eight on the album. "Thought you'd never ask," he grinned expansively. "This song probably says it the best." Nick sat down in one of the strange easy chairs and listened to a soft ballad with an easy beat in the background. The title of the song was "Let Me Take Care of You, Baby." It told the story of a gifted lover who made the songstress laugh at home or in bed. They were compatible, they were friends. But he couldn't talk commitment because he hadn't made it yet. So in the last stanza the woman singing the song appeals to him to swallow his pride and let her make it easy for him.

Nick looked at Troy and rolled his eyes while he shook his head. "Jefferson," he said, "you're too much. I never know when you're telling the truth and when you're slinging bullshit with both arms."

Troy laughed and stood up from the couch. "But, Professor," he protested, "that's what makes it more interesting." He came over and took Nick's empty beer can. "It's hard for you to believe, isn't it?" he said, still smiling

while he looked directly at Nick, “that maybe your funny black first mate has a few dimensions you haven’t seen.”

Troy turned and walked toward the kitchen. Nick could hear him opening beer cans and putting the chips in a bowl. “So,” Nick hollered, “I’m waiting. What’s the scoop?”

“Angie and I have known each other for five years,” Troy said from the kitchen. “When we were first dating she was only nineteen and completely naive about life. One night we were over here, right after I first moved in, and we were listening to a Whitney Houston album. Angie started singing.”

Troy came back in the living room. He put the bowl of assorted chips on the little wood coffee table and sat down in a chair next to Nick. “The rest, as they say in Hollywood, is history.” He waved his arms. “I introduced her to the owner of a local night club. Within a year she had a recording contract and I had a problem. She was my woman. But I couldn’t afford to keep up with her.” Troy was uncharacteristically quiet for a few seconds. “It’s really shit when your pride stands in the way of your feelings for the only woman you’ve ever loved.”

Nick was surprised to discover that Troy’s intimate revelation had touched him. Nick leaned forward in his chair and dropped his hand lightly on Troy’s shoulder in a gesture of understanding. Troy changed the subject quickly. “And what about you, Professor? How many broken hearts are hanging in your closet? I’ve seen the way Julianne and Corinne and even Greta look at you. Why haven’t you ever married?”

Nick laughed and guzzled his beer. “Christ, this must be my lucky day. Do you know, Jefferson, that you’re the second person today to ask me about my love life? And the first one was a seventy-year-old woman.”

Nick took another drink. “Speaking of Greta,” he continued, “I ran into her this morning — and it wasn’t an accident. She was waiting for me while I was talking to Amanda. She knew that we found something yesterday and wanted to talk about a partnership deal. Do you know anything about this?”

“Sure do,” Troy answered easily. “Homer must have had her spying on us. When I finished up with the boat last night, she was waiting to pump me for information. She had watched you leave with your exercise bag and either guessed or knew that we had found something. I didn’t tell her anything, although I didn’t deny it either. Remember, Ellen saw Carol and me in the marina office with all that snazzy equipment.”

“Yeah, I know,” said Nick, “and I really didn’t expect to keep it entirely under wraps forever. I just wish we could find more of the treasure, if it exists, before those snoops start to follow our every move.”

The two men sat in silence, drinking their beer. “But you’ve managed to avoid my question,” Troy said at length with a mischievous smile. “The subject was women. How come a guy like you, handsome, educated, apparently not gay, does not have a steady woman?”

Nick thought for a moment. He studied Troy’s friendly, guileless face and decided to take the plunge. “I’m not sure, Troy,” he said seriously, “but I think maybe I push them all away. I find something wrong with them so I have an excuse.” A new idea crept into Nick’s mind. “Maybe I’m getting even in a way. You asked about broken hearts? The biggest one in the closet is my own. Mine was torn to shreds when I was a kid by a woman who probably doesn’t even remember me.”

Troy rose from his chair and walked over to the disc player to change the music. “Listen to us,” he said lightly, “both struggling with the infinite complexity of the female species. May they remain forever crazy and mysterious and wonderful. And by the way, Professor” — Troy’s characteristic grin had returned, — “I brought this subject up to warn you. Unless I miss my guess, that reporter lady has her sights set on you. She likes challenges. And so far you have given off nothing but negative signals. To say the least.”

Nick jumped up from his chair with a spurt of energy. “I’m going for another beer, my good man. Until just this moment I had thought that I was talking to someone with insight and understanding. Now I find that I’m talking instead to some stupid black man who thinks ‘asshole’ is a term of endearment.” He paused briefly on his way to the kitchen to pick up some potato chips. “By the way,” he shouted at Troy between crunches on his chips, “you said on the phone that you wanted to show me something. Was that the Angie Leatherwood album or was it something else?”

Troy met him in the hall as Nick was returning with the beer. “No,” he said earnestly, “it was something else. But I wanted to talk to you for a little first to make sure . . . well, I’m not sure why, maybe to give me some confidence that you wouldn’t put me down.”

“What are you talking about?” Nick said, a little confused.

“It’s in here,” Troy replied, knocking on a closed door off the hall in the opposite direction from the living room. “It’s my baby. I’ve been working on it for over two years now, alone most of the time — although Angie’s artistic kid brother Lanny has helped me with some of it — and now I want you to try it out.” He smiled. “You will be my first alpha tester.”

“What the hell . . . I’m lost. What’s an alpha tester?” Nick’s brow furrowed as he tried to follow the conversation. The two quick beers on an empty stomach had already given him a small and unexpected buzz.

“My invention,” Troy said slowly, letting each word sink in, “is a computer game. I’ve been working on it for almost two years. And you are going to be the first outsider to play it.”

Nick screwed up his face as if he had just eaten a particularly tart piece of grapefruit. “Moi?” he exclaimed. “You want me to play a computer game? You want me, whose hand-eye coordination is almost nonexistent even when completely sober, to sit down and shoot aliens, or dodge bombs, or roll marbles at a frenzied pace that only neo-adolescents can enjoy? Jefferson, have you lost your mind? This is Nick Williams, the guy you call the Professor, the man who sits and reads books for entertainment.”

“Very, very good,” Troy replied, laughing heartily at Nick’s outburst. “You’re perfect as an alpha tester. My game is not one of those arcade games that test your reflexes, although there are a few places in the game where the pace is fairly fast. My creation is an adventure game. It’s a little like a novel, except that the player defines the outcome of the game. I’m aiming at a wide audience and I’m including a lot of unusual technological wrinkles. I would love to see how you respond.”

Troy took Nick’s shrug as grudging assent and opened the door to what should have been the master bedroom in the duplex unit. Instead, what greeted Nick’s eyes was an almost phantasmagoric collection of electronic equipment filling every nook and cranny of a fairly large room. His first impression was one of total chaos. But after shaking his head and blinking a couple of times, Nick could make out some order in the jumble of scopes, monitors, cables, computers, and sundry unattached parts. On one side of the room was a chair about ten feet in front of a giant screen. Between this chair and the screen was a low table with a keyboard on it. Troy motioned to Nick to sit down.

“My game is called Alien Adventure,” Troy said excitedly, “and it will start as soon as I boot the discs and you are ready at the keyboard. But there are some things that I must tell you first, before you start.” He knelt beside Nick and pointed at the keyboard. “There are three critical keys for you to remember while you are playing the game. First, the X key stops the clock. From the moment you start the game, the clock continues to run. While the clock is running you are consuming vital resources. There is only this one way to stop the clock and gather your wits without paying a penalty. Hitting the X key allows you to stop and think.

“Even more important than the X is the S key. The S allows you to checkpoint or, as you would say, save the game. Right now you can’t understand what I’m telling you, because you haven’t played complicated computer games before, but believe me, you must learn regularly to save the game. When you hit the S key, all the parameters of the game you are playing are written into a special data base that has a unique identifier. Then, at any time in the future, you can call that identifier and the game will restart in exactly the place where you saved it. This feature can be a life saver. If you take a risky route in the game and your character ends up dying, it’s the save game feature that keeps you from having to start all over again.”

Nick was amazed. This was a different Troy than he had ever seen before. True, he had been a little surprised and considerably impressed by his first mate’s ability to fix virtually any piece of electronic gear on the boat, but never in his wildest dreams had he imagined that Troy left the boat and went home to work with similar parts in a much more creative way. Now this same smiling black man had him sitting in a chair in front of a giant screen and was lecturing him patiently like a child. Nick could hardly wait to see what would happen next.

“Finally,” Troy said, asking with his eyes if Nick was still following him, “there’s the H or help key. When you simply have run out of imagination and don’t know what to do, you can push H. The game will then give you some hints on how you might proceed. But I must warn you of one thing. The clock continues to run while you are being helped. And there are some places in the game, during a battle for instance where pushing the H key can be disastrous, because you are essentially defenseless during the time that the game processes your request for help. H is most useful when you are in a benign spot and trying to figure out your overall strategy.”

Still squatting beside him, Troy handed Nick a small spiral notebook and motioned for him to open it. The first page said “Command Dictionary.” On each page was a separate entry, legibly written by hand, that explained the game command that would result from hitting the key listed at the top of the page. “Here are the rest of your commands, fifty in all,” Troy said. “But you don’t need to memorize them. I’ll help you. You’ll learn some of them yourself after you play the game for a while. Most of the important commands are activated by a single stroke on the keyboard, but some of the commands require two entries.”

Nick flipped through the notebook. He noted that the key L prompted the command “Look.” But another entry was necessary to identify what instrument was being used to look. L followed by a 1, for example, meant to look with your eyes. L8 meant to look with an ultraviolet spectrometer, whatever that was. Nick was already overwhelmed. He looked over at his friend, who was busy making final checks on some equipment.

Troy came back to the chair and looked down at Nick. “Now,” he said, “I think you’re ready Any questions?”

“Just one, my lord and guide,” Nick replied with mock meekness. “May I please have another beer before I risk my manhood in some weird world of your creation?”

Actually Nick was not yet ready to play the game. Even after Troy booted three compact discs, there were more preliminary activities before Nick could begin the game itself. He had to enter his name, race, age, and sex in response to questions that appeared on the giant screen. Nick looked at Troy with a curious tilt of his head and a weird expression on his face. “Don’t ask questions at this point,” Troy told him, “it will all be clear soon enough.”

The screen next was filled with a beautiful ringed planet that looked like what an artist who favored purple might make out of Saturn. The perspective was from the pole of the planet; the rings were all displayed like the different sections of a dart target. Little flecks of light gleamed intermittently from

the rings, indicating that the sun or star or whatever was the source for the reflected light was in the vicinity of the viewer. It was a lovely picture. A simple credit in block titles, Alien Adventure by Troy Jefferson, was superimposed on the ringed planet for three or four seconds and the sound of soft classical music could be heard in the room. Nick resisted an urge to chuckle when he heard Troy's voice, clearly serious and selfconscious, coming from one of the speakers.

Troy's recorded voice explained the initial conditions for the game. The adventurer was on a space station in polar orbit around Gunna, the largest planet belonging to another solar system whose central body was the G-type star that we call Tau Ceti, only ten light years or so away from the Earth. "Tau Ceti has eight primary bodies in its system," Troy's voice said, "including six planets and two moons.

"Maps of the system are available at the commissary on the space station," Troy's voice continued, "although some of the regions have been incompletely mapped. When your adventure begins, you are sleeping in your cabin onboard the station. An alarm sounds on your personal receiver . . ."

The voice faded and the sound of an alarm could be heard. The picture on the giant screen was the inside of a space cabin, almost certainly taken from one of the many successful science fiction movies. In the upper right hand corner of the screen was a game digital clock that was changing by one unit every four seconds or so. Nick looked helplessly at Troy. Troy suggested that he hit the L key. In a few seconds Nick learned that he could use the direction keys on the board to look at specific items in his cabin. Each time he hit a direction key, the picture on the screen changed to correspond to a different point of view. Nick noticed that there was a fuzzy picture on his small television and followed Troy's suggestion to watch until it became clear.

When the focus on his cabin television sharpened, Nick could see a young woman wearing a long, full, richly red dress that dropped almost all the way to the floor. She was standing, somewhat incongruously, in a small, stark room furnished with a single bed, a little desk, and a straight chair. Some light was entering the room through the solitary window near the ceiling and behind the desk. Thick vertical bars were imbedded in the window glass.

The camera zoomed in on her face. Nick leaned forward in his chair in Troy's apartment. "Why . . . why it's Julianne," Nick said in astonishment, just as the woman began to speak.

"Captain Nick Williams," she said, much to his surprise, "you and I have never met, but your reputation for valor and justice is unequaled in the Federation. I am Princess Heather of Othen. While attending the great ball at the inauguration of the Viceroy of Toom, I was kidnapped by willens and taken to their stronghold on the planet Accutar. They have told my father, King Merson, that they will not release me unless he cedes to them all the ore-rich asteroids in the Endelva region.

"He must not do that, Nick," the princess continued earnestly as the camera zoomed in on her face, "or he will deprive our people of their only source of hanna, the key to our immortality. My sources tell me that already my father wastes away, brooding over his impossible predicament. My sister Samantha has fled from Othen with a key division of our best soldiers and a huge store of hanna. It is not clear whether she intends to try to free me or to revolt against my father's rule in the event that he should decide to give up the Endelva asteroids in exchange for my life. She has always been completely unpredictable.

"Yesterday the willens delivered an ultimatum to my father. He must make his decision in one month, or they will behead me. Captain Williams, please help me. I do not want to die. If you come and rescue me, I will share with you the Othen throne and the secret of our immortality. We can live forever as king and queen."

The transmission stopped suddenly and the picture was gone. The screen again showed a picture of the inside of Nick's cabin onboard the space station. Nick resisted an impulse to applaud and sat without moving. Somehow Troy had made Julianne into a very believable Princess Heather. But how did my name get into the script? he wondered. He wanted to ask questions but a warning message flashed on the giant screen, indicating that time was passing and the adventurer was not taking any action. Nick found the X key and the digital clock on the screen stopped. He turned to Troy. "So what do I do now?"

With Troy's occasional help, Nick equipped himself for a journey, found his way to the spaceport, and climbed in a small shuttle craft. Despite Troy's hints that his chances for survival in "open space" were small unless he spent more time examining the other facilities on the space station, Nick blasted off anyway. It was great fun. He used the commands on the keyboard to control his speed and direction. What he saw on the screen was perfectly matched with his commands, giving him the illusion that he was actually flying a vehicle through space. He saw many other vehicles on the monitor as he maneuvered toward his target, a planet named Gunna, but none of them approached his shuttle. Just outside the Gunna sphere of influence, however, a needle-nosed craft approached him quickly and then, without warning, blasted him with a battery of missiles. Nick was unable to escape. The screen filled with fire from the explosion that ripped through his shuttle. Then the monitor went blank and black except for the simple message "Game Over" in white letters in the middle of the screen.

"Time for another beer? Nick asked, surprised to discover that he was actually disappointed by the death of his character.

"Right on, Captain," Troy replied.

They walked into the kitchen together. Troy opened the refrigerator and pulled out two more beers. He handed one to Nick. The professor was still absorbed in thinking about the game. "If I remember correctly, there were four sections marked on that map of the space station," Nick said aloud. "And I only went in two of them. Would you mind telling me about the other two sections?"

"You missed the cafeteria and the library," Troy said delighted that Nick was still interested. "The cafeteria is not all that important," he added, laughing, "although I've never known you to go anywhere before without eating first. But the library — "

"Don't tell me," Nick said, interrupting him. "Let me figure it out. In the library I can learn about willens and the Otheners, or whatever they're called, who can live forever and what exactly is a Viceroy of Toom." He shook his head. "My, my, Troy. I must say that I am more than a little impressed. I have no idea how anyone could create something like this; And I have a feeling that I've just scratched the surface."

"I take it you're ready to continue, Professor?" Troy replied, acknowledging the praise with a huge grin. "One piece of advice. While you're in the library, look in the Encyclopedia of Space Vehicles so you can at least tell a hostile ship when it appears. Otherwise you're never going to reach the exciting parts of the game."

The afternoon passed quickly Nick found that escape into the imaginative world of Troy's game was magnificently relaxing, just the tonic that he needed after the morning memories of Monique. Troy knew that Nick was enjoying the playing and he was thrilled. He felt a surge of creative pride and his belief that Alien Adventure would be his ticket to success was reborn.

In his vain search for Princess Heather, Nick died a couple more times. Once, when he landed on the unmapped planet Thenia, a black man with a lizard head approached him and told him to leave, that there was nothing but trouble on Thenia. Nick ignored the warning and moved away from his shuttle in a land rover. He narrowly escaped a volcanic eruption only to be trapped and eaten by

a gigantic slime mold that oozed out of the ground in the vicinity of his shuttle landing site.

In another reincarnation Nick encountered Samantha, Princcss Heather's sister, played for a couple of scenes by Julianne's buxom friend Corinne. Actually, Troy had made Corinne up to look like Susie Q, the famous porn queen of the early nineties, and most of the actual pictures that appeared on the game screen were taken from her ribald classic Pleasure Until Pain. Deft interleaving of new footage with the borrowed shots gave the illusion of being in the movie with Susie Q while she offered sexual delights beyond refusal.

Samantha alias Susie Q alias Corinne seduced Nick and then stabbed him to death with a small dagger while he was lying naked and expectant on the bed. By this point the two men were drinking their final six-pack of beer and the combination of the pornographic scenes and the alcohol had made their conversation coarse and degenerate. "Shit," exclaimed Nick, entreating Troy to replay the scene where a naked Samantha/Susie Q comes up to the camera to take his erect penis in her mouth. "I have never, no never, even heard of a computer game where you almost get a blow job. Man, you are twisted. A genius, yes, I'll agree. But absolutely fucking twisted. What on God's earth induced you to put sex scenes in this game?"

"Hey, man." Troy laughed, putting his arm around Nick as they half staggered into the living room, "the name of the game is sales. And right here, in Entertainment Software (he picked up a magazine from the table), it says that seventy-two percent, seventy-two fucking percent, my friend, of all the people who buy computer games are 16- to 24-year-old males. And do you know what that group likes in addition o computer games and science fiction? Sex, my man. Can't you just see some teenage nerd retreating into his room to play this game and whack off? Eeee yaaa!" Troy fell down on one of the easy chairs and beat his chest.

"You're crazy, Jefferson," Nick said, watching Troy's display. "I don't know if I can ever again be alone with you on a boat. You are a certified nut case. I mean, just imagine the reviews. Alien Adventure features an encounter with Susie Q the queen of pornography, in an underground castle on the asteroid Vitt. Which reminds me, how in the world did you get all those movie pieces in there?"

"Lots of research and hard work, Professor," Troy answered, starting to calm down a little. "Lanny and three of his friends have spent maybe a thousand hours watching film for me, trying to find exactly the right clips. And none of this would be possible, of course, without the new data storage methods. We can now store an excellent digital version of every movie ever made in the United States in a warehouse not much larger than this duplex. I've just used data base capabilities to the fullest."

Nick crushed a beer can in his hands. "It's fabulous. Really. But I don't know about the sex business. And why do you have the player register his race at the beginning of the game? Don't you think that will offend some people? I never saw anything in the game that was based on the racial information."

Even though he was drunk, Troy became momentarily serious and almost somber. "Look, man," he said firmly, "sex and race are both a part of life. It may be true that people play computer games primarily for entertainment, and that they would prefer not to be confronted by some topics when they are amusing themselves, but I must be allowed some creative license. Race is with us every day and ignoring it, it seems to me, only contributes to the problem."

Troy brightened up. "Hey, Professor. That lizard-man who warned you on Thenia was black. You went ahead anyway despite his warning. What if he had been white? Would you have turned around and gone back to the shuttle? A black man playing the game encounters a white lizard-man on Thenia. It's part of the

show, man. There are twenty or so changes in the scenario that are based on racial input."

Nick's expression was clearly disbelieving. "Really," Troy said, standing up to return to the room where they had played his game, "I'll show you. Watch how the game starts if you register that you are a black male."

Nick followed Troy back into the computer room. His curiosity was clearly piqued. Troy turned the game on and Nick entered the biographical data, changing his race to black. This time, when the television picture in his space station cabin came into focus, Princess Heather was black! The princess this time was, in fact, Angie Leatherwood. "Well, I'll be damned," Nick said, looking over at a beaming Troy. "You are one clever dude, Mr. Jefferson." Nick walked out of the room whistling and shaking his head again. Troy turned off the game and followed.

"Okay," Nick began, once they were back in Troy's living room and seated on the couch, "one last question and then let's forget the game for the time being. How did you get my name into it? I thought that was very impressive."

"It was originally Lanny's idea, based on a movie he watched about a speech therapist. Lanny had all the minor characters spend a day mouthing all the vowel and consonant sounds in a test session. Then we just put the sounds together with what are called audio analytic continuation techniques." Troy laughed. He was feeling ebullient and basking in the compliments. "But it does have its drawbacks. Our interpreter only knows how to read simple English words. We may have to suppress that feature if we sell the game abroad."

Nick stood up. "Well, I've run out of superlatives By the way, are there more of you, brothers, sisters, anything? I guess I'd like to warn the rest of the world."

"Only me now," Troy replied. a faraway look fleetingly crossing his face. "I had a brother, Jamie, six years older than me. We were very close. He died in an automobile accident when I was fourteen."

There was an awkward silence. "I'm sorry," Nick said, again touched by Troy's openness. Troy shrugged his shoulders and struggled with the sudden memory.

Nick changed the subject. They talked about the boat and then about Homer and his crew for several minutes. Suddenly Nick looked at his watch. "Jesus Christ," he said. "It's after four o'clock. Weren't we supposed to meet Carol Dawson at four?"

Troy jumped out of his chair. "We sure were. Some partners we turned out to be," he was grinning again, "spending the entire afternoon drinking beer and playing games." The two men shared a small hug, threw the empty beer cans in the trash, and went out the door toward Nick's car.

7

CAROL was clearly irritated as she sat in the communications room at the Marriott. She was drumming her fingers on the desk while she listened to the telephone ring. There was a click and then Nick's voice said, "I am not at home at the present time. But if — " She flipped the switch off hastily and completed the sentence, her sardonic mimicry releasing some of her frustration, "But if you'll leave your name, your number, and the time that you called, I'll get back to you as soon as I return. S-h-i-t. Shit. I knew I should have called before I left Miami."

She dialed another number. Bernice answered and put her right through (on video) to Dr. Dale Michaels. Carol did not bother with a greeting. "Can you believe that I can't even find the stupid bastard? He's not on his boat, he's not at home. Nobody knows where he is. I could have stayed in Miami and taken a nap."

Carol had not told Dr. Dale much about Nick and Troy. And what she had said about Nick had not been flattering.

· 'Well, what did you expect?" Dale responded. "You wanted to go out with amateurs as a cover. Why would you think that he would be easy to find before your appointment? That kind usually stays in bed with his dame of the day until he has some reason to greet the world." Dale chuckled to himself

Carol found herself strangely annoyed by Dale's disdainful comment about Nick's love life. She started to say something but decided against it. "Say, Dale," she said instead, "is this phone line absolutely secure? I have a couple of sensitive items to discuss with you."

He smiled. "Nothing to worry about. I have sensors that flash if there is the slightest unexplained break anywhere in the line. Even on your end."

"Good," Carol replied. She pulled out her notebook and scanned a handwritten list. " As far as Arnie Webber knows," she said, looking up at the video camera, "there are no legal prohibitions against salvaging any U. S. government property, provided it is returned to its rightful owner very soon after its retrieval. So I wouldn't technically be committing a crime if I pull the missile up." She checked the first item off her list.

"But, Dale, I thought about something else on the flight down here from Miami. This thing is, after all, some kind of guided missile. What if it blows up? Am I crazy to worry about such a thing? Or is it somehow incapacitated or what-ever by sitting down there in the sand and salt water for several days?"

Dale laughed. "Sometimes, Carol, you're divine. I am fairly confident that the new missile is designed to operate either in the air or in water. And I don't think that the sand would be able to foul up its critical parts in a short period of time. However, the fact that it hasn't exploded yet suggests to me that it probably wasn't armed in the first place, except possibly for a small destruct device that may or may not have already failed. You are taking a calculated risk in retrieving that missile. I still strongly suggest that you make your dive, obtain the photographs, and then go public with the story. Dredging the missile up for display purposes seems to me to be more of a stunt than journalism. Besides, it's dangerous."

Carol was curt. "As I said in the car, you are entitled to your opinion. The Navy could make a case that I faked the pictures somehow. But they cannot argue with a missile that has physical presence and can clearly be seen by a nationwide television audience. I want maximum impact for the story."

She checked another item off the list in her notebook. "Oh, yes, I forgot to mention this morning that I met another boat captain down here, a bit of a creep actually, an older fat man named Homer. He seemed to recognize me almost immediately. Wealthy, big yacht and all that. Strange crew — "

"Was his last name Ashford? Homer Ashford?" Dale interrupted her.

Carol nodded. "So you know him?" she asked.

"Certainly," Dale replied. "He was the leader of the expedition that found the Santa Rosa treasure in 1986. You've met him too, although it's obvious you've forgotten. He and his wife were guests at the MOI awards banquet early in 1993." Dale stopped to think. "That's right. I remember now, you were real late coming to the party because of that threat made against you by Juan Salvador. But I'm surprised you forgot them, the wife especially. She was a great big fat woman and she thought you were the cat's pajamas."

Slowly but surely it all clicked in Carol's memory. She recalled a bizarre evening right after she first started going with Dale. She had run a piece in the Herald on cocaine trafficking and had suggested that the Cuban city councilman, Juan Salvador, was deliberately inhibiting the police investigations. At noon that day, a usually reliable source had called her editor at the paper and told him that Senor Salvador had just purchased a contract on Carol's life. The Herald had assigned her a bodyguard and

recommended that she alter her normal schedule so that her whereabouts would always be uncertain.

The evening of the MOI banquet Carol was in a fog. The bodyguard had been with her for only three hours and already she felt confined and restricted. But Carol had been genuinely frightened by the threat. At the banquet she had scrutinized every face, looking for an assassin, waiting for someone to make a move. As she sat in the hotel communications room fourteen months later, she did vaguely remember meeting Homer (he had been dressed in a tux) and some jolly fat woman who had followed her around for twenty minutes or so. Damnit, Carol thought. It's my memory again. I should have recognized him immediately. How stupid of me.

"Okay," Carol said to Dale, "I remember them now. But why were they at the MOI awards banquet?"

"We were honoring our leading benefactors that night," Dale replied. "Homer and Ellen have been big supporters of our underwater sentry effort. In fact, he has field tested many of our prototypes at his facility there in Key West. Real solid test data too. Best compilation of sentry/intruder responses that anybody has catalogued. Why? it was Ashford who showed us how the MQ-6 could be fooled — "

"Okay, Okay," Carol said, realizing that her tolerance threshold was still extremely low. "Thanks for the information. It's now a quarter till four. I'm going to go down to the marina to meet Nick Williams and make arrangements for tomorrow. If anything new comes up, I'll call you at home tonight."

"Ciao," said Dale Michaels. trying without success to sound sophisticated, "and please be careful."

Carol hung up the phone with a sigh. She wondered if she should spend a minute or two figuring out where she and Dale were going. Or not going. As the case may be. She thought about all the things she needed to do. She closed her notebook and rose from her chair. Not right now, she thought I don't have time now to think about Dale. But as soon as I have a break in this crazy life of mine.

Carol was really fuming when she walked back into the marina headquarters the second time. She approached the information desk with fire in her eyes. "Miss," she said nastily to Julianne, "as I told you fifteen minutes ago, I had an appointment here at four o'clock with Nick Williams and Troy Jefferson. It is now, as you can see, after four-thirty."

Carol pointed at the digital clock with an impatient, sweeping gesture that commanded Julianne to look. "We have both established independently that Mr. Williams is not home," Carol continued. "Now ate you going to give me Mr. Jefferson's phone number, or should I make a scene?"

Julianne did not like Carol or her obvious attitude of superiority. She held her ground. "As I told you, Miss Dawson," she said politely but with a biting overtone, "marina policy prohibits our giving out the phone numbers of the independent boat owners or their crew members. It's a question of privacy. Now if you had a formal charter through the marina," Julianne continued, enjoying her moment of glory, "then it would be our job to assist you. But as I said earlier, we have no record — "

"Goddamn it, I know that," replied Carol furiously. She slammed the envelope of photos that she was carrying down on Julianne's counter. "I'm not an imbecile. We've been through this before. I told you I was supposed to meet them here at four o'clock. Now if you won't help me, I want to talk to your superior, the assistant manager of whatever."

"Fine," said Julianne, her eyes firing darts of contempt at Carol. "If you will just take a seat over there, I will see if I can locate — "

"I will not take a seat," shouted Carol in exasperation. "I want to see him now. This is an issue of extreme urgency. Now pick up the phone and — "

“Is something wrong here? Perhaps I can help.” Carol spun around. Homer Ashford was standing right behind her. Just to the right, toward the gate in the direction of the jetties, Greta and a big heavy woman (That’s Ellen. Now I remember her, Carol thought) were talking quietly. Ellen smiled at Carol. Greta looked right through her.

“Well, hello, Captain Homer,” Julianne said sweetly, “it’s nice of you to ask. But I think everything’s under control. Miss Dawson here has just indicated that she does not accept my explanation of marina policy. She is going to wait for — ”

“Maybe you can help,” Carol interrupted Julianne defiantly. “I had an appointment here at four o’clock with Nick Williams and Troy Jefferson. They have not shown up. Do you by any chance happen to know Troy’s phone number?”

Captain Homer gave Carol a suspicious look and exchanged a knowing glance with Ellen and Greta. He turned back to Carol. “Well, it is certainly a surprise, Miss Dawson, to see you back here again. Why we were just talking about you this morning, saying that we hoped you had a good time on your free day in Key West.” He paused for effect. “Now I wonder why you’ve come back here again, the very next day. And did I hear correctly, you need to see Williams and Jefferson on an issue of extreme urgency? It couldn’t possibly have anything to do with all that equipment you brought in here yesterday, could it? Or the little gray bag that Williams has been guarding since last night?”

Uh oh, thought Carol, as Greta and Ellen moved in around her. I’m surrounded. Captain Homer started to pick up the sealed envelope on Julianne’s counter but Carol stopped him.

“If you don’t mind, Captain Ashford,” she said firmly, taking his hand off the envelope and putting the photos under her arm. She lowered her voice. “I would like to talk to you privately.” Carol nodded her head at the two women. “Can we go out in the parking lot together for a minute?”

Homer’s beady eyes squinted at her. Then his face broke into the same obnoxious, lecherous smile that Carol had seen on the Ambrosia. “Certainly, my dear,” he said. He shouted to Greta and Ellen as he walked out the door with Carol, “Wait here. I’ll only be a minute.”

Necessity is the mother of invention, Carol thought to herself as she led Homer Ashford out the door. So invent, bitch. And now. As in this moment.

They walked up the steps to the parking lot. Carol turned to Captain Homer at the top of the steps with a conspiratorial look on her face. “I can tell that you’ve figured out why I’m here,” she said. “I didn’t want it this way, I thought it would make a better story if nobody knew what I was doing. But you’re obviously too clever for me.” Homer grinned foolishly. “But I would ask you to tell as few people as possible. You can tell your wife and Greta, but please nobody else. The Herald wants it to be a surprise.”

Homer looked puzzled. Carol leaned over and almost whispered in his ear. “The entire Sunday magazine section the fourth week in April. Isn’t that unbelievable? Working title, ‘Dreams of Being Rich,’ stories about people like you, like Mel Fisher, like the four Floridians who have won over a million dollars each in the lottery. On how sudden income changes your life. I’m doing the whole piece. I’m starting with the treasure angle because of its general interest.”

Carol could see that Captain Homer was reeling. She knew she had him off guard. “Yesterday I just wanted to check your boat quickly, see how you lived, see how it would photograph. I freaked out a little when you recognized me so fast. But I had always planned to go out with Williams first.” Carol laughed. “My treasure-finding equipment from MOI faked him out. He still thinks I am a genuine treasure seeker. I almost completed my whole interview with him yesterday. I only came back today to finish a couple of small items.”

An alert went off in Homer Ashford’s system when Carol talked about faking out Nick Williams. Homer wasn’t certain he believed this smooth reporter’s

story even now. He mused to himself that her story was plausible, but there was still one big unanswered question. “But what is Williams carrying around in that bag?” he asked.

“That,” said Carol, sensing his distrust, “is nothing.” She raised her eyebrows and laughed again. “Or almost anyway. We pulled up a worthless old trinket yesterday afternoon so I could photograph the salvage process for the story. I told him to have it appraised today. He thinks I’m an eccentric. He must be keeping it hidden in the bag because he’s embarrassed and doesn’t want anybody to see him with it.”

Carol lightly hit Captain Homer in the ribs with her elbow. He shook his head. Part of him realized he was being told a very clever lie. But somehow enough of it made sense that Homer couldn’t pierce the deception. His brow furrowed for a moment. “So I guess you’ll want to talk to us when you’re through with the other two . . .”

At just that moment, unbeknownst to Carol, Nick and Troy drove into the marina parking lot. They were still slightly drunk and silly. “Lawdy, lawdy,” said Troy, spotting Carol and Captain Homer in conversation, “I believe my eyes have screwed up. They’re sending a picture of a beauty and a beast to my brain. It’s Miss Carol Dawson together with our favorite fat captain. Now what do you suppose they’re talking about?”

“I don’t know,” said Nick, bridling instantly, “but I’m damn sure going to find out. If she’s double-crossing us . . . .” He pulled the car quickly into a parking place and started to jump out. Troy reached across and restrained him.

“Now why don’t you let me handle this one?” Troy said. “Humor may be just the right ticket here.”

Nick thought for a moment. “Maybe you’re right,” he said. “I’ll let you go first.”

Troy walked into view just as Carol and Captain Homer were finishing their conversation. “Helloooo, angel,” he said from forty yards away, “what’s happening?”

Carol held her hand up in acknowledgment but didn’t turn around to greet Troy. “So that’s 2748 Columbia, just beyond the Pelican Resort, at eight-thirty tomorrow night?”

“Right,” replied Homer Ashford. He nodded his head in Troy’s direction and started to leave. ‘We’ll be ready for you. Bring plenty of tape, for it’s a long story.” He made a peculiar clucking sound with his mouth. “And plan to stay for a little party afterward.”

Homer was already halfway down the steps when Troy walked up beside Carol. “Hello, Captain Homer. Good-bye, Captain Homer,” he said quietly, still playing the comic. He leaned over to kiss Carol on the cheek. “Hi there, angel . . .”

“Yuch,” Carol pulled her cheek away. “You smell like brewery. No wonder I’ve had to look all over town for you two.” She saw Nick coming toward them across the parking lot. He was carrying the exercise bag. She raised her voice. “Well, Mr. Williams, what a pleasant surprise. How nice that you and your brother here could climb down from your bar stools long enough to keep our appointment.” She looked at her watch. “My, my,” she said in her most sarcastic voice, “we are certainly fashionably late. Let’s see, if one waits fifteen minutes for a full professor, how long does one wait for a fake professor?”

“Knock off the bullshit, Miss High and Mighty,” Nick said, responding angrily to her barbs. He joined Carol and Troy and then caught his breath. “We have a few bones to pick with you as well,” he continued. “Just what were you doing talking to that asshole Ashford?”

Nick sounded threatening. Carol recoiled. “Listen to him,” she said, “the typical macho male. Always shifts the blame to the woman. ‘Hey bitch,’ he says, ‘forget I’m late, forget I’m an arrogant bastard, it was your fault anyway . . .’ ”

“Hey, hey . . . hey,” Troy interceded. Carol and Nick were glowering at each other. They both started to speak but Troy interrupted them again. “Children, children, please,” he continued, “I have something important to say.” They both looked at him. Troy raised his arms for quiet. Then he adopted a stiff pose and pretended to be reading. “ ‘Fourscore and seven years ago, our forefathers brought forth upon this continent a new nation . . .’ “

Carol cracked up first. “Troy,” she said, smiling despite her anger, “ you are something else. You are also ridiculous.”

A grinning Troy punched Nick on the shoulder. “How did I do, Professor? Would I make a good Lincoln? Could a nice young black boy play Lincoln for the white folks?”

Nick smiled reluctantly and looked down at the macadam while Troy jabbered. When Troy was finished, Nick’s tone to Carol was conciliatory. “I’m sorry we were late,” he said in measured tones, “we forgot what time it was. Here’s the trident.”

Carol recognized how difficult it had been for Nick to apologize. She accepted gracefully with a short smile and a gesture with her hands. “You keep the trident for a little while longer,” she said after a brief silence. “We have a lot of other things to talk about.” She looked around. “But this may be the wrong place and the wrong time.”

Both Nick and Troy were giving her questioning looks. “I have some very exciting news,” she explained, “some of which is here in your copy of the pictures that I developed this morning. Bottom line is that the telescope picked up an infrared signal coming out of the fissure from some kind of large object or objects.” She turned to Nick. “It may be more treasure. We can t be certain what it is based on the images.”

Nick reached for the envelope. Carol pulled it away. “Not here, not now. Too many eyes and ears. Take my word for it. What we have to do now is make plans. Can you two take me out again tomorrow morning early and be prepared to salvage objects possibly as big as two hundred pounds? Of course, I intend to pay for chartering the boat again.”

“Wow,” whistled Nick, “two hundred pounds! I can hardly wait to see the pictures . “ He was sobering up rapidly . “ We’ll need to borrow a dredger and _ ”

“I still have the telescope so we can use it again,” Carol added. She looked at her watch. “It’s almost five o’clock now, how much preparation time do you need?”

“Three hours, four hours at the most,” Nick said, calculating swiftly. “With Troy’s help, of course,” he added.

“Gladly, my friends,” Troy replied. “And since Angie has reserved a special table for me at Sloppy Joe’s for her ten-thirty show tonight, why don’t we meet there and go over the details for tomorrow?”

“Angie Leatherwood is a friend of yours?” Carol said, obviously impressed. “I haven’t seen her since she made the big time.” She paused for a second and handed the envelope to Nick. “Look at these images in private. The whole set was taken just under the boat where we were diving. Some are obviously blowups of others. It may take a little time for your eyes to adjust to all the colors. But it’s the brown object or objects that we’re after.” Carol could tell that both of the men were eager to see the pictures. She walked with them toward Nick’s car. “So I’ll see both of you tonight at Sloppy Joe’s about ten-fifteen.” She turned to head for her own parking place.

“Uh, Carol, just a minute,” Nick stopped her. Carol waited while Nick, suddenly awkward, tried to figure out a nice way to ask his question. “Would

you mind telling us why you were talking to Captain Homer?" he at last said tactfully.

Carol looked at Nick and Troy for a minute and then laughed. "I ran into him while I was in the office trying to call you guys. He wanted to know about the piece we retrieved yesterday. I put him off the track by telling him I was doing a feature article on all members of the crew that found the Santa Rosa treasure eight years ago."

Nick glanced at Troy with mock disgust "You see, Jefferson," he said with exaggerated emphasis. "I told you there was a legitimate explanation." The two men waved at Carol as she headed for her car.

8

LIEUTENANT Todd," the commander said with exasperation, "I am beginning to think that the U.S. Navy has overestimated your intelligence or experience or both. It is beyond me how you can continue even to consider the possibility that the Panther was commanded off course by the Russians, particularly in light of the new information you presented this afternoon."

"But, sir," the younger man answered stubbornly "it is still a viable hypothesis. And you yourself said in the meeting that a good failure analysis does not exclude any reasonable possibility."

The two men were in Commander Winters' office. The commander walked over to look out the window. It was almost dark outside. The air was heavy, still, and humid. Thunderstorms were building over the ocean to the south. The base was nearly empty. At length Winters looked at his watch, heaved a sigh, and came back across the room toward Lieutenant Todd. He was smiling only slightly.

"You listened well, Lieutenant. But the operative word here is 'reasonable.' Let's review the facts. Did I or did I not hear correctly that your telemetry analysis unit found this afternoon that the commands rejected counter on the bird also incremented during the flight, beginning as early as off the coast of New Brunswick? And that, apparently, over one thousand command messages were rejected as the missile made its way down the Atlantic Coast? How do you propose to explain all this in terms of your scenario? Did the Russians deploy an entire fleet of ships along the flight path, just to confuse and capture one solitary Navy test missile?"

Commander Winters was now standing directly in front of the taller young lieutenant. "Or maybe you believe," he continued sarcastically, before Todd could respond, "that the Russians have a new secret weapon that flies alongside a missile going at Mach 6 and talks to it en route. Come on, Lieutenant, on what reasonable grounds do you consider this bizarre Russian hypothesis of yours still viable?"

Lieutenant Todd did not yield. "Sir," he answered, "none of the other possible explanations for the missile's behavior makes any more sense at this stage. You now say that you believe it's a software problem; however, our very brightest programmers cannot imagine how the only external indication of a major, system-level software malfunction could be that two, and only two, command counters go haywire. They have checked all the internal software diagnostic data that was telemetered to the ground and they can find no problems. Besides, the pre-release checkout indicates that all the software was working fine just seconds before the flight began.

"And we know something else. Ramirez has learned from Washington that there have been peculiar movements in the Russian submarine fleet off the Florida coast in the last forty-eight hours. I'm not saying that the Russian hypothesis, as you call it, is the answer. Just that until we have a more satisfactory explanation of a failure mechanism that could cause both command

counters to increment, it makes sense to carry one option that assumes maybe the Panther was actually commanded."

Winters shook his head "All right, Lieutenant," he said finally. "I will not order you to take it off the list. But I will order you to concentrate this weekend on finding the missile in the ocean somewhere and identifying a hardware and/or software problem that could have caused either the command counter anomaly or the change in the flight path or both. There must be an explanation that does not involve operations on a massive scale by the Russians."

Todd started to walk around Winters and leave. "Just a minute," the commander said, his eyes narrowing. "I don't believe it's necessary, is it Lieutenant, to remind you of who will be held responsible if the outside world gets wind of this Russian business?"

"No, Commander . . . sir," was the answer.

"Then carry on," said Winters, "and let me know if there are any significant new developments."

Commander Winters was in a hurry. He had called the theater right after Todd had left and told Melvin Burton that he was going to be late. He drove quickly into a hamburger stand, wolfed down a burger and fries, and headed for the marina area.

He arrived at the theater when most of the rest of the cast was already dressed. Melvin met him at the door. "Quickly now, Commander, we have no time to spare. The makeup must be correct the first time." He looked nervously at his watch. "You're in the pulpit in exactly forty-two minutes." The commander entered the men's dressing room, took off his Navy uniform, and put on the dour black and white regalia of an Episcopal priest. Outside the door to the dressing room Melvin paced back and forth, going through a final checklist in his mind.

Commander Winters was in the pulpit when the curtain rose. He had a strong case of normal opening-night jitters. He looked across the three rows of his stage congregation to the full audience in the theater. He saw his wife Betty and son Hap in the second row. Winters smiled at them quickly before the applause died down. Then his nervousness disappeared as he launched into Shannon's sermon.

The short prologue sped by quickly. The lights dimmed another time for fifteen seconds, the set changed automatically, and he was in the final scene, walking into his hotel room in Mexico and still mumbling to himself phrases from his letter. Shannon/Winters sat down on his bed. He heard a noise in the corner of the room and looked up. It was Charlotte/Tiffani. Her gorgeous auburn hair was down over her shoulders. She was wearing a light blue silk nightshirt, cut low in the middle, which her ample and upright breasts filled completely. He heard her say, "Larry, oh Larry, finally we're alone together," and she came to sit beside him on the bed. Her perfume filled his nostrils. Her hand was behind his head. Her lips pressed against his, insistent, hard, searching. He pulled back. Her lips followed, then her body. He fell back on the bed. She crawled on top, her kisses continuing, her breasts pushed against his pounding chest. He put his arms around her, slowly at first, and then, lying on his back, he enveloped her with a deep embrace.

The lights flashed off and on for several seconds. Charlotte/Tiffani slid off of Winters and lay beside him on the bed. He could hear her labored breathing. A voice was heard, "Charlotte." Then again, with a loud knock on the door, "Charlotte, I know you're in there." The door sprang open. The two lovers half sat up in bed. The lights went off and the curtain came down. The applause was loud and sustained.

Commander Vernon Winters pushed open the door and stumbled outside. He was at the alley entrance to the theater. The door, over which was a single

light bulb covered with insects, opened onto a small wooden platform a few steps above the pavement. Winters walked down the three steps and stood beside the red brick wall of the theater. He pulled out a cigarette and lit it.

He watched the smoke curl upward against the red brick. In the distance there was a burst of lightning, then a pause before the sound of rolling thunder. He inhaled deeply again and tried to understand what he had been feeling during those five or ten seconds with Tiffani. I wonder if they could tell, he thought. I wonder if it was obvious to everyone. When he had changed clothes for the first full act of the play, he had noticed the telltale tracks on his undershorts. He expelled some more smoke and winced. And that little girl. My God. She knows for sure. She must have felt it when she was on top of me.

Despite himself, he recaptured for an instant his excitement when Tiffani had pressed herself against him. His breath shortened. A first tinge of guilt began to manifest itself. My God, he thought again. What am I? I'm a dirty old man. For some reason he found himself thinking of Joanna Carr, of a night almost twenty-five years ago. He remembered the moment when he took her . . .

"Commander," he heard a voice say. He turned around. Tiffani was standing on the platform in her T-shirt and jeans, her long hair down over her shoulders. Now she was walking down the steps toward him. "Commander," she said again with a mysterious smile, "may I have a cigarette?"

He was dumbfounded, stupefied. He said nothing. Winters automatically reached into his pocket and pulled out his pack of Pall Malls. The girl took one, packed it against her fingernail, and slid it into her mouth. She waited a second, maybe two. Then she gave him another smile. Winters at last woke up and produced his cheap supermarket lighter. She cupped his trembling hand and inhaled vigorously on the cigarette.

Winters watched her, fascinated, as she pulled the smoke into her lungs. He studied her mouth, her white neck, her uplifted chest as she caressed the smoke. With the same rapt attention, he watched her diaphragm subside and the smoke curl out of her pursed lips.

They stood there together, quietly smoking, neither speaking. Over the ocean there was another flash of lightning, another roll of thunder. Each time that Tiffani would put the cigarette in her mouth, the mesmerized Winters would follow her every move. She would inhale deeply, intently, pulling hard on the cigarette for the nicotine her body cherished. He was only vaguely aware of his jumbled thoughts.

She's beautiful, so beautiful. Young and fresh and full of life. And that hair. How I would love to wrap it around my neck . . . but she's not a little girl. She's a young woman. She must sense what I'm feeling, my fascination for her . . . she smokes as I do. With complete concentration. She caresses . . .

"I love stormy nights," Tiffani broke the silence as still another distant flash of lightning lit up the sky. She moved closer to him and then craned her neck to see around a group of trees that was blocking her view of the cloud formation where the lightning was occurring. She brushed against Commander Winters ever so slightly. He was electrified.

His mouth was dry. His body was suffused with desire, a desire he barely recognized. He could not answer her comment. Instead he stared off at the growing storm and took the final drag from his cigarette.

She too finished her cigarette and dropped it on the pavement. As she turned to face him and their eyes met, the last wisps of smoke were playfully wandering across her lips. She gave a quick, flirtatious blow with her mouth and Winters felt a burst of lust in his groin. He retained his self-control and they entered the theater in silence.

The applause continued. Commander Winters brought the women who had played Maxine and Hannah, one on either side of him, forward for their final bow, just as they had planned before the performance began. The applause intensified. Again he stared at the empty seats where Betty and Hap had been before the intermission. He heard a voice from the audience shout “Charlotte Goodall” and Winters improvised. He took the two ladies back to the line of the assembled cast and walked down the line to Tiffani. For a moment she did not understand. Then her face broke into a radiant smile and she took his hand.

He walked forward with her to the front of the stage. their hands wrapped together in a tight hold. This was her special moment. She was near tears as she heard the applause grow again. He stood aside and she bowed gracefully to the audience. She finished her bow, took his hand again with a delightful squeeze, and backed up into the line with the cast.

Melvin, Marc, and Amanda were all backstage while they were dressing. Enthusiastic congratulations were everywhere. Melvin particularly seemed ecstatic. He admitted that he had had some misgivings during rehearsals, but that everyone had been wonderful. The director confided to Winters that the bedroom scene with Tiffani had been “superb — couldn’t have been better,” as Melvin literally danced out the dressing room door.

Winters was overwhelmed with a myriad of emotions. He was pleased with his performance in the play and the audience reception, but other more personal things were on his mind. What had happened to Betty and Hap? Why had they left at intermission? In his mind’s eye, Winters imagined Betty watching his love scene with Tiffani. He had a momentary panic as he convinced himself that she had known, from out in the audience, that her husband was not acting at all, that he was every bit as aroused as the character he was playing.

What had occurred with Tiffani he could not begin to understand and could not even think about without starting to feel guilty. While he was putting back on his Navy uniform, he allowed himself to taste again her kisses on the bed in the play and to feel the sexual tension while they smoked together in the alley. But beyond his awareness of his arousal he would not go. Guilt was a depressing emotion, and on his successful opening night he did not want to be depressed.

When Commander Winters walked out of the men’s communal dressing room, Tiffani was waiting for him. Her hair was back in pigtails, her face scrubbed free of makeup. She looked again like a little girl. “Commander,” she said, almost with servility, “would you do me a favor, please?” He smiled his assent. She beckoned to him and he followed her out in the hall that was adjacent to the backstage quarters.

A red-haired man about the commander’s age was standing in the hall, nervously smoking a cigarette and pacing. It was obvious that he felt uncomfortable and out of place. Next to him was a tawdry brunette, early thirties perhaps, chewing gum and talking to the man in a whisper. The man noticeably relaxed when he saw the commander in his uniform.

“Well, sir,” he said to Winters when Tiffani introduced him as her father, “it’s good to meet you. I don’t know much about this acting business, but I worry that it’s unhealthy for my daughter sometimes.” He winked at his wife, Tiffani’s stepmother, and lowered his voice. “You know, sir, with all the wimps and fags and other weirdo actors, a man can’t be too careful. But Tiff told me there was a real Navy officer, a bona fide commander, as part of the cast. At first I didn’t believe her.”

Mr. Thomas was definitely getting signals both from Tiffani and his wife. He was talking too much. “I’m regular Navy myself,” he blurted out as Winters remained silent, “almost twenty-five years. Signed up when I was just a boy of eighteen. Met Tiff’s mother two years later — ”

“Daddy,” Tiffani interrupted him, “you promised that you wouldn’t embarrass me. Please just ask him. He probably has things that he needs to do.”

The commander had certainly not been prepared to meet Tiffani's father and stepmother. In fact, he had never for a moment even thought about her parents, although as he stood there, listening to Mr. Thomas, it all made sense. Tiffani was, after all, only a junior in high school. So of course she lives at home, he thought. With her parents. Mr. Thomas was looking very serious. For about a second Winters felt fear and the beginning of panic. No. No, he thought quickly, she can't have told them anything. It's all much too soon.

"My wife and I play bridge," Mr. Thomas was saying, "duplicate bridge, in tournaments. And this weekend there's a big sectional in Miami. We'll be leaving tomorrow morning and coming back very late on Sunday night."

Winters was puzzled. He was lost in this conversation. Why should he care about what the Thomases did with their free time? At length Mr. Thomas came to the point. "So we had called Mae's cousin in Marathon and asked her if she would pick my daughter up after the show tomorrow night. But that would mean Tiff would have to miss the cast party. Tiff suggested that maybe you would be willing to see her home safely from the party and," Mr. Thomas smiled pleasantly, "keep a fatherly eye on her while I'm off playing bridge."

Winters instinctively glanced at Tiffani. For just a few milliseconds he saw a worldly look in her eyes that tore through him like a fireball. Then she was a little girl again, entreating her father to let her go to the party.

The commander played his role well. "All right, Mr. Thomas," he replied, "I'll be glad to help you out." He patted Tiffani fondly. "She deserves to go to the party, she's worked hard. "He paused for a moment. "But I have a couple of questions. There will certainly be champagne at the party and it will probably go real late. Does she have a curfew? How do you feel about — "

"Just use your own judgment, Commander," Mr. Thomas cut him short. "Mae and I trust you completely." The man reached over and shook Winters' hand. "And thank you very much. By the way," he added, as he turned around to leave, "you were great, although I must admit I was worried when you were necking with my daughter. The fag that wrote the play must have been one weird dude."

Tiffani's stepmother mumbled thanks over her chewing gum and the girl herself said "See ya tomorrow" as the three of them walked away. The commander reached in his pocket for another cigarette.

Betty and Hap were both asleep, as Commander Winters knew they would be, when he finally arrived home around eleven o'clock He walked softly past his son's room but then stopped outside of Betty's. Basically a considerate man, Winters spent a few seconds weighing Betty's sleep against his need for an explanation. He decided to go in and wake her up. He was surprised to find that he was nervous when he sat down on the side of her bed in the dark.

She was sleeping on her back with a sheet and a very thin blanket both pulled up neatly to within about two inches of her shoulders. He shook her lightly. "Betty, dear," he said. "I'm home. I'd like to talk to you." She stirred. He shook her again. "It's Vernon," he said softly.

His wife sat up in bed and turned on the light on the end table. Underneath the light was a small picture of the face of Jesus, a man wise beyond his thirty or so years, with a full beard, a serious look, and a glow approximating a halo behind his head. "Goodness," she said, frowning and rubbing her eyes, "What's going on? Is everything all right?" Betty had never been particularly pretty. But in the last ten years she had ignored her looks altogether and had even put on twenty pounds of ungainly weight.

"Yes," he answered. "I just wanted to talk. And to find out why you and Hap left the show just after the intermission."

Betty looked him directly in the eyes. This was a woman without guile, even without nuance. Life was simple and straightforward for her. If you truly believed in God and Jesus Christ, then you had no doubts. About anything. "Vernon," she began, "I have often wondered why you choose to perform in such

strange plays. But I have never complained about it, particularly since it seems to be the only thing that has excited you in a good way since Libya and that awful beach incident."

She frowned and a cloud seemed to cross her face momentarily. Then she continued in her matter-of-fact way. "But Hap is no longer a child. He is becoming a young man. And hearing his father, even in a play, refer to God as a 'petulant old man' and a 'senile delinquent' is not likely to strengthen his faith." She looked away. "And I thought it was equally disturbing for him to watch you groping with that young girl. All in all," she said, glancing back at her husband and summarizing the entire issue, "I thought the play had no values, no morals, and nothing worth staying for."

Winters felt his anger building but struggled with it, as he always did. He envied Betty her steadfast faith, her ability to see God clearly in every daily activity. He himself felt disjoint from the God of his childhood and his fruitless personal searches had not yet resulted in a clearer perception of Him. But a couple of things Winters did know for certain. His God would laugh with and have compassion for Tennessee Williams' characters. And He would not be pleased by bombs falling on little children.

The commander did not argue with Betty. He gave her a brotherly kiss on the cheek and she turned off the light. For just a moment he wondered. How long has it been? Three weeks? But he couldn't remember the exact time. Or even whether or not it had been good. They "fooled around," as Betty called it, whenever her awareness of his need overcame her general lack of interest. Probably about normal for couples our age, Winters thought, somewhat defensively, as he undressed in his room.

But he was not able to sleep as he lay quietly in the dark underneath the sheet. The feeling of arousal that had been so intense first during the play and then again out in the alley continued to call to him. With pictures. When he closed his eyes he could again see Tiffani's soft and flirtatious lips blowing out the last of the smoke that had been deep within her lungs. His mouth could still taste those passionate kisses that she had forced upon him during the bedroom scene. And then there was that special look when her father had asked him to take care of her at the party. Had he imagined it?

Several times Commander Winters changed positions in his bed, trying to dispel the images in his mind and the nervousness that was keeping him awake. He was unsuccessful. Eventually, while he was lying on his back, he realized there was one possible release from this kind of tension. At first he felt guilty, even embarrassed, but the waves of images of Tiffani continued to flood into his brain.

He touched himself. The images from the day sharpened and began to expand into fantasies. She was lying on top of him on the bed, as she had been in the play, and he was responding to her kisses. For a brief second Winters became frightened and held himself in check. But a desperate surge of longing removed his last inhibition. He was again an adolescent, alone in his rich imagination.

The scene in his mind changed. He was lying naked on a huge king-size bed in an opulent room with high ceilings. Tiffani approached him from the lighted bathroom, also naked, her long auburn hair cascading over her shoulders and hiding the nipples of her breasts. She took a last languorous pull from her cigarette and put it out in the ashtray beside the bed, her eyes never leaving his as she slowly, almost lovingly, expelled the last of the smoke from her mouth. She climbed into the bed beside him. He could feel the softness of her skin, the tingle of her long hair against his neck and chest.

She kissed him gently but passionately, with her hands behind his head. He felt her tongue playing enticingly across his lips. She moved her body into position next to him and pressed her pelvis into his. He felt himself rising. She took his penis in her hand and squeezed lightly. He was completely erect. She squeezed again, then gracefully raised her body up and inserted him deep

inside her. He felt a magical moist warmth and then exploded almost immediately.

Commander Winters was staggered by the power and the intensity of his fantasy. Somewhere inside him a voice cried for caution and warned of dire consequences if he let this fantasy become too real. But as he lay spent and alone in his suburban home, he pushed his guilt and fears aside and allowed himself the unrivaled bliss of post-orgasmic sleep.

9

SLOPPY Joe's was an institution in Key West. The favorite bar of Hemingway and his motley crew had managed to adapt quickly to the multifaceted evolution of the city that it had come to symbolize. Many denizens of the old city had been almost apoplectic when the bar had forsaken its historic location downtown and moved into the vast shopping complex surrounding the new marina. But even they grudgingly admitted, after the club reopened in a well-ventilated large room complete with sound stage and excellent acoustics, that the Tiffany lamps, long wooden bars, narrow mirrors from ceiling to floor, and memorabilia from a hundred years in Key West had been tastefully rearranged in a way that retained the spirit of the old bar.

It was altogether fitting that Angie Leatherwood should perform as the headliner at Sloppy Joe's during her brief and infrequent returns to the city of her birth. Troy's glib tongue had originally talked the owner, a transplanted fifty-year-old New Yorker named Tony Palazzo, into giving her an audition when she was still nineteen. Tony had heard her sing for five minutes and then had exclaimed, punctuating his comments with wild hand gestures, "It's not enough that you bring me a black girl who's so beautiful she takes your breath away. No, you bring me one who also sings like a nightingale. Mama mia Life is not fair. My daughter Carla would kill to sound like that." Tony had become Angie's biggest fan and had unselfishly promoted her career. Angie never forgot what Tony had done for her and always sang at Sloppy Joe's when she was in town. She was like that.

Troy's table was front and center, about ten feet away from the edge of the stage. Nick and Troy were already seated at the small round table and had finished their first drinks when Carol arrived about five minutes before ten-thirty. She apologized and mumbled something about parking in Siberia. As soon as she arrived, Nick pulled out the envelope of images and both men told her that they had found the pictures fascinating. Nick began asking questions about the photographs while Troy summoned a waiter. Nick and Carol were involved in an earnest conversation about the objects in the fissure when the new drinks reached the table. Nick had just mentioned that one of them looked like a modern missile. It was ten thirty-five. The lights flashed off and on to announce that the show was beginning.

Angie Leatherwood was a consummate performer. Like many of the very best entertainers, she never forgot that it was the audience that was the customer, that it was they who both created her image and enhanced her mystique. She began with the title song from her new album, "Memories of Enchanting Nights," and then sang a medley of Whitney Houston songs, according a tribute to that brilliant songstress whose talent had sparked Angie's own desire to sing. Next she showed her versatility by blending a quartet of songs with different beats, a Jamaican reggae, a soft ballad from her first album, Love Letters, a nearly perfect Diana Ross imitation from an old Supremes song, "Where Did Our Love Go?" and an emotionally powerful, lilting encomium to her blind father entitled "The Man with Vision."

Thunderous applause greeted the conclusion of each song. Sloppy Joe's was sold out, including all the standing room along the hundred-foot bar. Seven

different huge video screens scattered throughout the spacious club brought Angie home to those who were not close to the stage. This was her crowd, these were her friends. A couple of times Angie was almost embarrassed because the clapping and the bravos would not stop. At Troy's table, very little was said during the show. The threesome pointed out songs they particularly liked (Carol's favorite was the Whitney Houston song, "The Greatest Love of All"), but there was no time for conversation. Angie dedicated her penultimate song, "Let Me Take Care of You, Baby," to her "dearest friend" (Nick kicked Troy under the table) and then finished with her most popular cut from Love Letters. The audience gave her a standing ovation and hooted noisily for an encore. Nick noticed while he was standing that he was a little woozy from the two strong drinks and was also feeling strangely emotional, possibly because of the subliminal associations created by the love songs that Angie was singing.

Angie returned to the stage. As the noise subsided, her soft and caressing voice could be heard. "You all know that Key West is a very special place for me. It was here that I was raised and went to school. Most of my memories bring me back here." She paused and her eyes scanned the audience. "There are many songs that bring back memories and the emotions that go with them. But of all of them, my favorite is the theme song from the musical Cats. So, Key West, this is for you."

There was scattered clapping as the music synthesizers accompanying her played the introduction to "Memories." The audience remained standing as Angie's mellifluous voice launched into the beautiful song. As soon as she began, Nick was instantly transported to the Kennedy Center in Washington, D.C., in June of 1984, where he was watching a production of Cats with his mother and father. He had finally come home to explain to them why he had been unable to return to Harvard after his spring break in Florida. But try as he might, he could not begin to tell the story to his disappointed father and brokenhearted mother. All he could say was, "It was a woman . . ." and then he would fall silent.

It had been a sad reunion. While he was visiting his home in Falls Church, the first malignant polyps had been discovered and removed from his father's colon. The doctors had been optimistic about several more years of life, but they had stressed that colon cancer often recurred and metastasized to other parts of the body. In a long talk with his suddenly frail father, Nick had promised to finish his degree in Miami. But that was little solace to the older man; he had dreamed of seeing his son graduate from Harvard.

The performance of Cats at the Kennedy Center had been only mildly entertaining for Nick. In the middle he had found himself wondering how many people in the audience really knew the author of the source material for the songs, this poet T.S. Eliot, who not only admired and enjoyed feline idiosyncrasies, but also once began a poem by describing the evening "spread out against the sky, like a patient aetherized upon a table." But when the old female cat walked to center stage, her beauty faded into wrinkles, and began her song of her "days in the sun," Nick had been moved right along with the entire audience. For reasons he never understood, he had seen Monique singing the song, years in the future. And in Washington he had wept, silent tears hidden quickly from his parents, when the achingly pure soprano voice had reached the climax of the song..

"Touch me . . . It's so easy to leave me . . . all alone with my memories . . . of my days in the sun . . . If you touch me . . . you'll understand what happiness is . . ."

Angie's voice at Sloppy Joe's was not nearly as piercing as that soprano in Washington But she sang with the same intensity, evoking all the sadness of someone for whom all the joys of life are in the past. The corners of Nick's eyes filled with tears and one of them brimmed out to run down his cheek.

From where Carol was standing, the lights from the stage reflected off Nick's cheek. She saw the tear, the window of vulnerability, and was herself moved in return. For the first time she felt a deep stirring, almost an affection for this distant, solitary, but strangely attractive man.

Ah Carol, how different it might have been if, for once in your life, you had not acted impulsively. If you had just let the man have his moment of loneliness or heartbreak or tenderness or whatever he was feeling, then you might have mentioned it later, at a quieter time, to some advantage. The sharing of this moment might even have eventually been part of the bonding between you. But you had to tap Nick on the shoulder, before the song was through, before he even realized himself that he was tearful, and break his precious communion with his inner self. You were an interloper. Worse, as so often happens, he interpreted your smile as derision, not sympathy, and like a frightened turtle withdrew completely from the evening. It was guaranteed that he would reject as insincere any subsequent overtures of friendship.

Troy missed the interplay between Carol and Nick. So he was quite surprised, when he turned around and sat down after the final applause, to find Nick's shoulders set in an unmistakable pose of hostility. "Wasn't she wonderful, angel?" Troy said to Carol. "And how about you, Professor? Was this the first time you heard her sing?"

Nick nodded. "She was great," he said, almost grudgingly. "And I am thirsty. Can a man get a drink in this place?"

Troy was slightly offended. "Well, pardon us," he said. "So sorry that the entertainment lasted so long." He tried to signal for the waiter. "What's eating him, angel?" he said conversationally to Carol.

Carol shrugged her shoulders. Then, trying to lighten the atmosphere, she leaned toward Nick and tapped him on the forearm on top of the table. "Hey, Nick," she said, "have you been taking angry pills?"

Nick quickly withdrew his arm and grumbled something inaudible as a reply. He turned away from the conversation and saw that Angie was approaching the table. He stood up automatically and both Carol and Troy joined him. "You were fantastic," said Carol, a little too loud, just as soon as Angie was within earshot.

"Thanks . . . Hi," replied Angie, as she walked up to the table and took the chair that Troy had pulled out for her. She spent a few moments graciously acknowledging the praise from people at the nearby tables. Then she sat down and smiled. "You must be Carol Dawson," she said easily, leaning across the table toward the reporter.

Angie was even more beautiful in person than she had been in the picture on the disc jacket. Her coloring was a dark brown, not quite black. Her makeup, including the light pink lipstick, was muted to permit her natural assets, including virtually perfect white teeth on prominent display when she smiled, to draw the attention. But beyond the beauty was the woman herself. No still photograph could do justice to the natural warmth that radiated from Angie. You liked her immediately.

"And you must be Nick Williams," Angie said, extending her hand to Nick. He was still standing, looking uncomfortable and uncertain, although Troy had already seated himself. "Troy has told me so many things about you in the past few days, I feel as if we're already friends. He claims that you've read every novel ever written that's worth reading."

"That's an exaggeration, of course," Nick replied, obviously pleased to be recognized. He seemed to loosen up a little and finally sat down. He started to add another comment but Carol jumped into the conversation and cut him off.

"Did you write that beautiful song about the blind man yourself?" she asked, before Angie had really had time to sit down and collect herself. "It seemed to be a very personal statement."

“Yes,” Angie answered Carol pleasantly, without a trace of irritation at Carol’s aggressive behavior. “Most of my material comes from other sources, but occasionally I write a song myself. When it is a very special subject for me.” She smiled briefly at Troy before continuing. “My father is a remarkable, loving man, blind from birth but with an uncanny comprehension of the world at all levels. Without his patience and guidance, I probably would never have had the courage to sing as a little girl. I was too shy and self-conscious. But my father convinced all of us when we were small that we were somehow special. He told us that God had given each of us something unusual, something uniquely ours, and that one of the great joys of life was discovering and then developing that special talent.”

“And that song, ‘Let Me Take Care of You, Baby,’ did you really write that for Troy?” Nick blurted out his question before Angie had finished her sentence. He thereby destroyed the soft mood created by Angie’s loving description of her father. Nick was on the edge of his chair and for some reason seemed agitated and unsettled. Troy wondered again what he had missed in the interaction between Carol and Nick that had caused his friend to become so tense.

Angie looked at Troy. “I guess so,” she said with a wistful smile, “although it was originally meant to be a playful tune, a light commentary on the game of love.” She stopped for a moment. “But it does talk about a real problem. It’s very hard sometimes being a successful women. It interferes — ”

“Amen. Amen,” Carol interrupted while Angie was still developing her thought. This was one of Carol’s favorite subjects and she was ready to pounce on the opportunity. “Most men cannot deal with a woman who is the least bit successful, much less in the spotlight.” She looked directly at Nick and then continued, “Even now, in 1994, there are still unwritten rules that must be followed. If you want to have a permanent relationship with a man, there are three don’ts: Don’t let him think you’re smarter than he is, don’t suggest sex first, and, above all, don’t make more money than he does. These are the three key areas where their egos are extremely fragile And if you undermine the ego of any man, even when you’re just kidding with him, then it s a lost cause.”

“Sounds like you’re an expert,” Nick replied sarcastically. His hostility was obvious. “I wonder if it ever occurred to any of you liberated females that men are not put off by your success, but rather by the way you handle it. What you accomplish in life does not mean shit at the personal level. Most ambitious, aggressive women I have met (and now he was looking directly at Carol) go out of their way to make male-female relationships into some kind of competition. They will not let the man, even for a moment, have the illusion that he lives in a patriarchal society. I think some of them purposely emasculate — ”

“There it is,” Carol jumped in triumphantly. She nudged Angie, who was smiling but still a little embarrassed at the rancor in this exchange. “That’s the magic word. Whenever a woman wants to argue and not accept as gospel some profound male truth, she is trying to ‘castrate’ or ‘emasculate’ — ”

“Okay, you guys,” Troy interjected firmly, shaking his head. “That’s enough. Let’s change the subject. I had thought that maybe you two could enjoy an evening together, but not if we’re going to start this way.”

“The problem,” Carol continued, now looking at Angie and ignoring Troy’s request, “is that men are frightened. Their hegemony in the Western world is threatened by the emergence of women who aren’t willing to be just barefoot and pregnant. Why, when I was at Stanford — ”

She stopped and turned when she heard the legs of a chair scraping across the Roor. “With all due respect, Miss Leatherwood,” Nick was standing up again, holding the chair in his hand, “I believe I will excuse myself. I thoroughly enjoyed your music, but I do not wish to subject you to any more bad manners. I wish you continued good fortune in your career and I hope that someday you can

spend some time on the boat with Troy and me." Nick turned to Troy. "I'll see you at the marina at eight o'clock in the morning." Finally he looked at Carol. "You, too, if you still want to go. You can tell us about the wimps at Stanford while we're out in the middle of the Gulf."

Nick did not wait for a reply He picked up the envelope and walked back through the crowd toward the exit. As he was approaching the door he heard a voice calling him, "Nick. Oh, Nick. Over here." It was Julianne, waving to him from a nearby table full of glasses and ashtrays. She and Corinne and Linda were surrounded by half a dozen men but Julianne was moving them all around and pulling up an empty chair. Nick walked over to her table.

Thirty minutes later Nick was very drunk. The combination of Julianne's occasionally brushing his leg, Corinne's gigantic breasts (they were covered now but he could remember them from Troy's game in the afternoon), and intermittent glimpses of Carol through the cigarette smoke had made him very horny as well. God damn it, Williams, he had thought to himself when he first sat down with Julianne's group. You blew it again. Here you had this perfect chance to charm her. Maybe even score. But half an hour later, after the drinks, his thoughts were more reminiscent of Aesop's fox. She's too aggressive for me anyway. Famous. Pushy. Probably too hard underneath And cold in bed. Another ballbuster. Yet still he watched her from across the room.

The extra chairs that had been brought in for Angie's performance were cleared away to make room for dancing. A disc jockey orchestrated the rest of the evening from a booth next to the stage; one could dance to a variety of modern musical selections, watch the outrageously overproduced music videos on the big screens. or just talk, for the music was not overwhelmingly loud. Most of the people around Nick were from the marina. During a break in the music, just after Nick had downed another fast tequila, Linda Quinlan leaned across the table. "Come on, Nick," she said, "let us in on your secret. What did you and Troy find yesterday?"

"Nothing special," said Nick, remembering his agreement but surprised to discover that he did indeed want to talk about it.

"Rumor says different," jumped in one of the men at the table. "Everybody knows that you took something to Amanda Winchester this morning. Come on, tell us what it was. Have you found a new treasure ship?"

"Maybe," said Nick, a drunken grin on his face, "just maybe." Another strong impulse pushed him to tell the story and show the pictures, but he stopped himself. "I can't talk about it," was all he would say.

At this moment two burly young men, short-haired Navy types wearing officer's uniforms, were making a beeline for Nick's table from the other side of the floor. One of them was dark, Hispanic. Their approach was confident, even arrogant, and their arrival at the table stopped all the conversation. The white lieutenant put his hand on Julianne's shoulder. "All right, gorgeous," he said boldly, "the Navy is here. Why don't you and your friend there (he nodded at Corinne — Ramirez was standing behind her), come and dance with us?"

Julianne said, "No, thank you," very politely and smiled. Todd looked down at her. He was weaving just a little and it was clear from his eyes that he had been drinking heavily.

"You mean to tell me," he said, "that you would prefer to sit here with these local geeks rather than dance with future admirals?" Julianne felt his hand tighten on her shoulder. She looked around the table and tried to ignore him.

Todd did not like rejection. He took his hand off Julianne's shoulder and pointed at Corinne's breasts. "Christ, Ramirez, you were right. They are monsters. Wouldn't you like to snarf one of those?" The two lieutenants laughed crudely. Corinne squirmed self-consciously.

Linda Quinlan's steady boyfriend rose from his chair. Other than Nick, he was the only one of the men at the table who was approximately the same size as Todd and Ramirez. "Look, guys," he said reasonably, "the lady said no very nicely. There is no need to insult her or her friends — "

"Listen to him, Ramirez," Todd interrupted, "this character said we insulted someone. Since when is admiring the size of someone's cachunga's an insult?" He chuckled to himself at his cleverness. Ramirez made a sign to leave but Todd waved him off.

The drunken Nick had been ready to explode all night. "Get out of here, asshole," he said, quietly but firmly. He was still sitting down next to Julianne.

"Who are you calling asshole, cocksucker?" the truculent Lieutenant Todd replied. He turned to Ramirez. "I do believe that I am going to be forced to strum the head of this impertinent bastard."

But Nick was ahead of him. Rising swiftly, he uncoiled a vicious punch that struck Todd full in the face and sent him tumbling backwards, into another table covered with drinks. Todd and the table crashed to the floor and Nick went after him. Ramirez pulled Nick off his fellow officer and, when Nick turned and swung at him as well, Ramirez gave Nick a push that caused his unsteady legs to give way. Nick fell back over Julianne and another full table collapsed upon the floor

From across the room Carol and Angie and Troy could see the fracas and recognize Nick in the middle of it. "Uh oh," Troy said, jumping up to go to his friend's aid. Carol was right behind him. When they reached the opposite side of the room, both club bouncers were already on top of the action. Meanwhile, Nick and Julianne were still trying to get unscrambled on the floor and Todd was slowly rising to his feet.

In the fight, the envelope of photos had been knocked free and a couple of them had fallen partially out. Ramirez had picked the envelope up off the floor and, because of the bright colors, was looking at the pictures. The close-up of the brown missile in the fissure was clearly visible in the top photo. "Hey," he said to the shaken Todd, "look at this. What do you think this is all about?"

Carol acted instantly. She walked past Ramirez, grabbed the envelope and pictures, and before he could say anything, she screamed, "Not again, Nick, no, I don't believe it. How could you be drunk again?" She knelt down beside Nick on the floor and cradled his head in her free hand. "Oh, darling," she said, as he stared at her in complete disbelief, "you promised that you'd stop."

The astonished crowd watched as Carol kissed Nick full on the mouth to prevent his saying anything. Troy was amazed. "Troy," she shouted a moment later, while Nick was trying to gather his wits. "Troy, where are you? Here, give me a hand." Troy rushed up and helped Nick to his feet. "We're taking him home now," she announced to the onlookers. She and Troy each took one arm and the three of them stumbled toward the door of the nightclub. They passed the manager in the doorway. Carol told him that she would come by the next day to settle accounts. She and Troy half carried Nick into the street.

As they walked away from Sloppy Joe's, Carol turned around and saw that part of the crowd had followed them to the door. Ramirez and Todd, the latter still rubbing his cheek, were standing in front of the group with puzzled expressions on their faces. "Where are we taking him, angel?" Troy asked when they were out of earshot. "We don't even know where he parked his car.

"It doesn't matter," Carol replied, "just as long as we are out of sight of the club."

The awkward threesome turned right, down the same alley that ran behind the theater where The Night of the Iguana had finished an hour before. Just past the theater there was a small vacant lot on the left Carol stopped the trio at the edge of the lot, opposite a grove of trees, and looked back to make

certain they were not being followed. She heaved a sigh and loosened her grip on Nick. She unconsciously fanned her sweating face with the envelope she had recovered from Ramirez.

Nick was now almost coherent. “I had no idea,” he mumbled to Carol, pulling his arm free from Troy and trying to embrace her, “that you felt that way about me.”

“I don’t,” Carol said emphatically. She pushed his arms away and backpedaled toward the vacant lot. Nick didn’t understand and continued his approach. “Stop,” she shouted angrily at him. “Stop, you drunken bastard.”

She tried to fend off his advance with her hands. But he kept coming. Just before Troy moved up to restrain him, Carol slapped Nick hard in the face with the hand that was not holding the envelope. Momentarily startled Nick lost his footing and fell into the grass on his stomach.

Still fuming, Carol bent down beside him and forcefully rolled him over on his back. “Don’t you ever, ever, use physical force with me,” she shouted at Nick. “Not under any circumstances.” She dropped the envelope on Nick’s stomach and stood up quickly. She looked at Troy, shook her head in disgust, and stalked off down the alley.

ASSEMBLY AND TEST

UNDER the scanning electron microscope they look like tightly coiled springs with a small tail. When they are placed in water or some other liquid, the springs seem to stretch out and cilialike appendages extend a few angstroms out from the tail to provide motility.

There are millions of them concentrated in a mixture the size of a tiny drop of water and they are being carefully checked by a laser device that is also counting and sorting them as it illuminates microscopic portions of the mixture. When the count is completed, the smaller division of the separated mixture is sluiced out of the metal receptacle and down a channel into another liquid, this one emerald green in color, that is contained in a bottle-shaped beaker. The springs spread out and follow random paths in wandering around the beaker.

External mechanisms regularly churn the emerald green liquid. Around the inside of the beaker, tiny sensors register the temperature, pressure, and exact chemical and electrical characteristics of the fluid. Some parameter is not absolutely perfect. A small valve opens a port in the base of the beaker and a new chemical is injected into the green solution. Continuous measurements monitor the diffusion of this additional material. At length the fluid is properly altered and a new equilibrium is reached.

Everything is now ready. From above several thousand small pellets are dropped into the container. Some of these pellets float on the surface but most sink to variable depths in the liquid. Embedded in each of the pellets is a complicated engineering construction on an amazingly miniaturized scale. The external surface of the pellets contains sensors that scan the nearby region of the liquid for the springlike objects. A high-frequency transmitter housed next to the sensors directs a call to the springs and attracts them to the neighborhood. Clusters of springs develop around each pellet.

Now, one at a time, these springs are harvested by small instruments inside the spongy outer section of the pellet and then loaded in carriers that are electrically fired toward the central cavity of the pellet. Within that cavity sits a single black, amorphous spot, its exterior constantly changing shape as its opaque material shifts around to follow unknown stimuli. This spot is surrounded by a yellow goo that fills the remainder of the cavity.

The first spring slips out of its carrier, then locates and penetrates the spot. The spring can be seen for an instant moving toward the center. However,

it is broken up and destroyed within milliseconds. Other springs are fired into the cavity at regular intervals and all try, after penetration, to reach some special region in the spot. Finally one of the procession succeeds and the spot changes color to bright red. In rapid succession, some enzyme in the spongy outer section of the pellet is dumped into the yellow goo, turning its color a little toward green, and all the rest of the springs disappear, apparently absorbed by the pellet structure. The entire pellet itself next elongates and extends a miniature propulsion system into the emerald liquid. After carefully steering around the many hazards, it then joins the queue of fertilized pellets moving, one by one, through a round diaphanous membrane in the bottom of the beaker.

The fluid dense with pellets speeds along a narrow tube until it reaches a partially closed container approximately the size of the beaker. Inside this translucent jar, a mechanical, spoonlike object digs into the stream of liquid flowing through and plucks out the pellets. They are lifted up and then suspended momentarily around the passing fluid in a heavy gas enclosed by the jar. Within moments each of the pellets splits and their carapaces apparently dissolve, leaving visible inside the jar an array of the little red spots surrounded by the off-yellow goo and suspended in an invisible gas.

The goo extends itself slowly throughout the jar above the flowing fluid until all the open areas between the red spots are filled. When the emerald stream below drops to a trickle and then disappears altogether, the goo hardens into a gelatin and fills the ports where the fluid once entered and departed. Within the jar are several thousand red spots embedded in the yellow-green gelatin. The spots undergo no visible change throughout this process.

Time passes. Activity in the jar ceases. Occasionally mechanical probes to test the stability of the gelatin are inserted into the jar at the old fluid ports. At last the translucent jar is removed from its storage location by what looks like a robotic forklift. It is placed on a moving belt that now carries it, along with several dozen other jars containing different kinds of objects (blue pencils, purple stars, and red boxes can all be seen) also suspended in yellow-green gelatin, to a vast circular oven almost an inch in diameter. Here all the jars are carefully baked together. Inside the oven, the molecules of the jar material immediately evaporate. Next a pair of disembodied manipulator hands wrap an incredibly thin blanket of connective filaments around all the gelatinous structures. After some time this ensemble unit is then pulled automatically out of the oven and packaged inside a gold metallic envelope whose several layers are designed to provide all the remaining environmental protection.

The hypergolic propellants mix and burst instantly into flame, pouring fire out the rocket nozzle. The slender vehicle rises, slowly at first, but later with astonishing speed. Before reaching the zenith of its flight, the rocket stage underneath the strange paraboloid payload falls away and tiny motors ignite on the underside of the flying boomerang. At the apex of the trajectory, the entire package suddenly explodes and apparently disintegrates. Hundreds of pieces of the original payload fall toward the surface of the planet in seemingly random directions.

Closer inspection reveals that each individual piece resulting from the explosion is made of a gold metallic material encased in plastic. A small sensor/propulsion package is attached to the plastic; it supplies needed vernier corrections during the descent after the controlled explosion. The plastic debris falls upon a strange, hybrid planet, obviously artificial judging by the wide variety of incongruous surfaces and cloud groupings that can be recognized from an altitude of tens of miles. There are scattered liquid lakes of different hues plus discontinuous surface topography with regions of desert and grasslands as well as barren mountains and canyons. A connected quarter of the

planet is covered with clouds . The clouds are here white and fleecy, there brown and thick. Some of the clouds are active, building and changing with hints of turbulence. Other parts of the cloudy region are static, small wisps of white stretching without change across the sky.

One of the plastic vehicles plunges through a misty blue cloudbank into an emerald sea. The plastic is left on the surface, but the encased gold metallic object sinks thirty feet to the floor of the ocean. For a day or two there is no discernible change in its appearance. Then a protrusion begins to form in its north polar region, on the top of the golden sphere as it sits on the ocean floor. The growth expands slowly, until the spherical shape appears to have a large carbuncle on its top. A metamorphosis now takes place. On the outside of the protrusion, the hard metal surface softens and begins to resemble an organic membrane. Although the membrane is thick and dense, it occasionally bulges, suggesting some motion on the other side of its golden barrier.

Eventually a thin black rod, a probe of some kind, thrusts through the surface into the emerald ocean. A second probe becomes visible, then a third, both long black rods like the first one, but each equipped with strikingly different apparatus scattered along the length of the rod. Something larger pushes against the membrane, once, twice, then finally breaking through. What a strange contraption! It’s an aerodynamic shape about three inches long, in two separate segments with a joint between them. The forebody is a nosecone; the afterbody is long and slender and tapers to a point. In addition to the three probes on the front of its forebody, it has four other furlable appendages or arms, two connected to the side of each segment.

It swims over to a nearby underwater plant with its arms stored next to its smooth body. There it unfurls the multi-faceted appendages and begins to examine the plant. An astonishing array of tiny instruments studies the plant for a few moments and then the entity moves away. The same procedure is repeated with each plant encountered. Eventually the thing finds a plant that it “likes” and its pincers remove a -major leaf. The leaf is neatly folded into a smaller volume and is then carried back to the object with the golden membrane.

The strange forager is joined by a partner, a carbon copy of itself, and by two fat fish with multiple arms and legs. The latter pair scuttle off to the side and begin modifying the ocean floor. Days pass. The things with the probes work ceaselessly, bringing more and more varieties of plant and animal life back to the home base. The legged fish meanwhile have constructed, out of available sand, rocks, shells, and living creatures, almost a thousand tiny, sealed rectangular homes on the ocean floor. These fish entities too work without break. Their next task is to transport each of the red spots, one at a time, from the golden cradle to their new houses.

If a microscope were available, it would show that some structure was already developing inside the red spots, giving them definition and distinction, by the time of their initial transport. But they are still very, very small. Once the red spots and their gelatin protection are carefully implanted inside their tiny houses, the foragers make routine stops on each trip to deposit a portion of their harvest. At the same time, the fish with legs, the architects and builders of the rectangular houses, begin working on transparent, igloolike homes for the embryos of another species.

A year later moonlight falls on the emerald lake. Several hundred eager, excited, wriggling necks, some royal blue and some pale blue, struggle upward to find the moon. Their heads pivot to face all directions and maybe two dozen separate indentations and orifices can be seen in each face. The necks crane this way, then that way. The silent serpents are searching for something.

From the direction of the moon a bizarre ship approaches on the water. It is large compared to the young serpents, its twin towers standing about eight

feet out of the water and about six feet above, on the average, a squarish platform fifteen feet on a side that forms the bottom of the boat. The top surface of this platform is irregular, undulating, and cratered. The platform floats smoothly upon the water.

The ship comes into the middle of the serpents and stops. The serpents divide into two groups according to the color of their necks and then line up on either side of the ship in very orderly rows and columns. A single musical note, a B-flat with a Hautish timbre, comes from the ship. Quickly the note is repeated up and down the rows and columns by each of the serpents on the two sides of the boat. Then a second note issues forth from the ship, also sounding like a flute, and the process repeats itself. For hours the music lesson continues, covering a range of both notes and chords, until some of the serpents on each side lose their voices The exercise concludes with an attempted ensemble performance by the royal bluenecked serpents, but the result is a painful cacophony.

Inside the ship, every note, every movement, every response by the juvenile serpents to the music lesson is carefully monitored and recorded. The ingenious engineering design of the boat is based upon the key controlling elements of the original cradle. However, although segments of gold metallic material (as well as the long black rods and even portions of the fat fish with legs) appear in the computer that runs the ship, the primary constituents of its mass are derived from great quantities of local rock and organic matter taken from the floor of the emerald lake. The ship is the quintessential music teacher, a virtually perfect synthesizer equipped with microprocessors that not only store all the responses of the pupils, but also contain software that will allow experimentation with a range of individualized methods of teaching.

But this sophisticated robot, engineered by the artificial .intelligence packed around the serpent zygotes and made almost entirely of chemical compounds extracted from material found in the neighborhood of the landing point, is itself being watched and studied from afar by test engineers. The current test is in its earliest stages and is progressing splendidly. This is the third different configuration tried for the music teacher, the hardest part of the design of the cradle that will carry the serpent zygotes back to Canthor. The first was an abysmal failure; the embryos developed into adolescents all right, but the teacher was never able to instruct them well enough that they could sing the mating song and reproduce. The second design was better; it was able to teach the serpents to perform the courtship symphony and a new generation of the species was produced. However, this next group of adult serpents was not able subsequently to teach their progeny to sing.

The best of the bioengineering personnel in the Colony were brought in to study this problem. After pouring over quadrillions of bits of accumulated data associated with the development of the serpents and other related species, they found a curious correlation between the degree of nurturing provided by the parent and the resulting ability of that infant, upon reaching maturity, to teach its own offspring. The artificial intelligence package responsible for the first six months of serpent life was then redesigned to include a surrogate mother whose only purpose was to hold and cuddle the fledgling serpents at regular intervals. Subsystem tests proved successful; this slight alteration of the early nurturing protocol produced adult serpents that were able to teach their children to sing

This demonstration test lasts for more than four millcycles. At the end of the period, the test is declared an unqualified success. A strong, creative serpent population nearing twenty-five thousand fills the artificial lake. Limitations to future growth are only test related. Eventually the test survivors are transported to another locale in the Zoo Complex and the Canthorean serpents are added to the list of species ready for zygote repatriation.

SATURDAY

1

THE full moon rises over the placid ocean. Troy stares at the moonbeams, watching them shimmer on the quiet water. Angie appears and stands in the water in front of him. She is wearing a skintight white bathing suit, one piece, and is submerged from the waist down.

She beckons to him and he walks across the damp sand toward the water. He is barefoot and is also wearing a white bathing suit. The water is surprisingly warm. Angie begins to sing. Her magnificent voice enfolds him as Troy draws nearer to her in the light surf.

They touch and kiss. She pulls away and gives him a smile of encouragement. Troy feels himself becoming aroused. Suddenly a siren pierces the air, destroying the calm of the night. Instantly the sea becomes choppy, agitated, full of whitecaps. Troy turns around, alarmed, and glances at the shore. He sees nothing special. He looks back at the ocean. Angie has disappeared. Out in the distance, near the horizon, Troy thinks he sees the beginning of a tidal wave. The siren shrieks again and Troy sees a large shapeless mass riding a nearby wave in the moonlight.

He goes toward the object. The tidal wave is now defined in the distance, filling half his dream screen. The bulky object nearby is a black body dressed in a red muscle shirt and bluejeans. The siren grows louder. Troy rolls the body over and looks at the face. It is his brother, Jamie.

Troy Jefferson bolted upright in bed. his heart pounding furiously, his mind making the transition from the dream world to reality. Outside his duplex apartment a siren raged. He could tell from the frequency change that the police car or ambulance had just sped past his front door. He shook himself and crawled out of bed. The digital clock on the end table read 3:03.

Troy walked to the kitchen. He went to the refrigerator and poured himself a glass of grapefruit juice. He listened to the siren in the distance until it faded away altogether. Then he started back to the small second bedroom where he slept. In the hallway he was stopped by the sound of another siren, this one even louder, that seemed to be coming toward him. For a few seconds he thought the siren was just outside his front door and he recalled, vividly, another siren in the middle of another night. His heart began to pound anew. “Jamie,” Troy said to himself almost involuntarily, “Jamie. Why did you have to die?”

Troy could still see the events of that evening with perfect clarity. Nothing in the first tableau had faded even a little. The beginning memory was the three of them, Jamie, Troy, and their mother, sitting silently at the dinner table, eating fried chicken and mashed potatoes. Jamie had just arrived home from Gainesville for spring break that afternoon and had spent almost an hour, before they had sat down to eat, regaling his fifteen-year-old brother with stories of football and university life. Jamie had been Troy’s idol throughout his childhood. Handsome, intelligent, and articulate, Jamie had also been blessed with incredible physical gifts. As a result, he had been the starting halfback for the Florida Gators in his sophomore year and was being touted as a potential All-American for the following season. Troy had bitterly missed Jamie when he had first gone away to the university, but in the intervening eighteen months he had learned to accept his absence and to look forward to his brother’s holiday visits.

“So, bro,” Jamie had said with a smile, when he finished his dinner and pushed his plate away, “what about you? You’ve finished another quarter already. Did you make the grades of a future astronaut?”

“I did okay,” Troy had replied, hiding his pride. “I made a B plus in Social Studies because my teacher thought I had taken an anti-American position in my paper on the Panama Canal.”

“I guess an occasional B plus is acceptable,” Jamie had laughed, his affection for his younger brother clearly showing. “But I bet Burford didn’t make many B’s when he was in the ninth grade.”

Whenever Troy recalled the fateful evening that his brother was killed, he always remembered the mention of Guion Burford, the first American black astronaut. Most of the time his memory, because it was so painful to proceed immediately to the terrible recollection of his dying brother in his arms, would choose to digress to a happier time, to a remembrance of his brother Jamie that was almost as vivid as the death scene, but was happy and reinforcing instead of being gut wrenching and depressing.

During the summer before his death, on a hot, humid day in late August, Jamie Jefferson had arranged a third personal meeting with his football coach at Florida to request permission to skip practice for two days. He wanted to take his little brother, Troy, to see the launch of the space shuttle. In the first two meetings, the coach had vigorously opposed Jamie’s taking the time away from the important workouts, but he had stopped short of denying the request.

“You still don’t understand, coach,” Jamie had said firmly at the start of their third and final meeting on the subject. “My little brother has no father. And he’s a genius at math and science. He blows the top off those standardized aptitude tests. He needs a role model. He needs to know that blacks can do something significant other than sports.” The coach had eventually relented and given Jamie permission, but only because he had figured out that Jamie was going to go under any circumstances.

Jamie had driven his battered Chevrolet nonstop across Florida, picked up his brother in Miami, and continued northward without sleeping for another four hours to Cocoa Beach. They had arrived in the middle of the night. Jamie, by now exhausted, parked the car in a beach access zone next to a seven-story condominium along the nicest part of the beach. “All right, little brother.” he had said, “now get some sleep.”

But Troy had not been able to sleep. He had been too excited thinking about the launch scheduled the next evening, the eighth shuttle launch in all, the first one that had ever occurred at night. He had been reading everything he could find about astronaut Burford and the plans for the mission. He kept imagining that it was the future and that he, Troy Jefferson, was an astronaut about to be launched into space. After all, Burford was living proof that it could indeed be done, that a black American could attain the upper echelons of society and become a popular hero on the basis of his intelligence, personality, and hard work.

At sunrise Troy had crawled out of the car and walked the few yards to the beach. It was very quiet. Troy’s company was limited to a few walkers and joggers plus a couple of those bizarre sand crabs, whose eyes wavered back and forth at the end of peculiar stalks as they raced sideways into their holes in the sand. To the north Troy could see some of the launch pads for the unmanned rockets at Cape Canaveral Air Force Base, but in his mind’s eye he saw them as the launching apparatus for the shuttle. He wondered what astronaut Burford was doing at that very moment. What was he eating for breakfast? Was he with his family or with the astronaut crew?

Jamie had awakened around noon and the brothers had spent the early afternoon on the beach together, laughing and playing in the surf. Then they picked up some hamburgers and drove the final half hour to the Kennedy Space Center. Jamie had strongarmed an avid Gator booster, an aerospace executive who

lived in Melbourne, for tickets to the VIP viewing area. They arrived there just before nightfall. Four miles away, the impressive shuttle launch configuration. consisting of the orbiter mounted on top of an orange external tank with two solid rocket boosters on the side, stood erect against its launching tower as the final countdown began.

No observing experience in Troy's life would ever come close to rivaling his watching the space shuttle blast off that night. As he listened to the countdown being announced over the loudspeakers in the VIP area, he was eager and anticipant, but not yet in awe. The moment the engines ignited, however, filling the Florida night with reddish-orange flame and thick white clouds of billowing smoke, Troy's eyes nearly popped out of his head. But it was the combination of his seeing the giant spaceship, slowly and majestically lifting itself into the heavens riding a long slender flame, and his hearing the astonishing sound, a constant roar punctuated with unexplained pops (which at only four miles away still arrived twenty or so seconds behind the sight of the engine ignition), that really caused the goose bumps to break out on his skin, the tears to come to his eyes, and the tingle to spread through his body. Troy's intense emotional excitement lasted well over a minute. He stood beside his brother Jamie, tightly holding his hand, his back arched as he strained to follow the flame rising higher and higher and then finally disappearing in the night sky above him.

After the launch they slept again in the car. Jamie then dropped Troy at the bus station in Orlando and headed back to Gainesville for football practice. Young Troy felt that he was a new person, that he had been transformed by his experience. In the week that followed he obsessively followed the flight. Burford became his hero, his new idol. During the first two quarters of the following year, he applied himself avidly to his schoolwork. He had a goal. He was going to be an astronaut.

Little did Troy know that on a March night only seven months later he would have another experience, this one devastating and deeply disturbing, that would completely overshadow the thrill he had felt at the shuttle launch. On that later March evening, his brother Jamie would stop by his room before leaving the house around eight o'clock. "I'm going over to Maria's, bro," Jamie would say. "We'll probably take in a movie."

Maria Alvarez was eighteen and still a senior in high school. She had been Jamie's steady girl for a couple of years. She lived in Little Havana together with her Cuban family and eight siblings.

Troy had given his brother a hug. "I'm glad you're here, Jamie. There are so many things that I want to show you. I made you a set of headphones in school — "

"I want to see everything." his brother had interrupted him. "But tomorrow, first thing in the morning. Now don't stay up too late. Astronauts need plenty of sleep so they can be alert." Jamie had smiled and walked out of Troy's room. It was the last thing Troy would ever hear him say.

Troy never could remember what he had heard first when he had awakened in the middle of that night. His mother's wild wail had mixed with the screech of the nearby sirens to create an imbroglio of sound that was unforgettable and terrifying. Troy had raced to the door and into the front yard wearing only his pajama bottoms. The sound of the ambulance siren was drawing closer. His mother was at the end of the short walkway in front of the house, bending down over a dark body spread partly in the street in front of Jamie's Chevrolet and partly in their yard. Three policemen and half a dozen curious bystanders were huddled around his distraught mother.

"Somehow," he heard one of the policemen say as Troy, in a panic, tried to figure out what was happening, "he managed to drive home. It's incredible after all the blood he lost. He must have been hit four times in the stomach . . ."

His mother's cry intensified again and, at that moment, Troy put all the pieces together and recognized the body lying on its back. A chill went through him, he gasped, and then Troy fell on his knees beside his brother's head. Jamie was struggling for breath. His eyes were open but they did not seem to be focusing on anything.

Troy cradled Jamie's head in his hands. He looked down at his brother's stomach. His red shirt was awash in blood that seemed to be flowing in a continuous stream from an area just above the genitals. Blood was on Jamie's jeans, on the ground, everywhere. Troy felt himself gag, then retch involuntarily. Nothing came up. Hot tears filled his eyes.

"We think it was a gang shooting, Mrs. Jefferson," the policeman droned on. "Probably some kind of a mistake. Everybody knows that Jamie wasn't mixed up with that kind of crowd." Reporters had arrived. Lights were flashing from cameras. More sirens approached.

Jamie's eyes went blank. There was no sign of breathing. Troy pulled his brother's head to his chest. He instinctively knew that Jamie was dead. He began to sob uncontrollably. "No," he mumbled. "No. Not my brother. Not Jamie. He never hurt anybody."

Someone tried to comfort him, to pat him on the shoulder Troy shrugged them off violently "Leave me alone," he shouted between sobs. "He was my brother. He was my only brother." After a couple of moments, Troy tenderly placed Jamie's head back down on the ground. He then collapsed in total despair beside him.

At almost three-thirty in the morning some ten years later, in March of 1994, Troy Jefferson would be at home, alone in his duplex, awake with the memory of that terrible moment when Jamie had died. He would feel a new the heartbreak of that loss. And he would realize again, very clearly, that most of his adolescent dreams had died with his brother, that he had forsaken his dreams of college and being an astronaut because they were inextricably coupled with his memory of Jamie.

Somehow he had stumbled through high school in the three years that had followed Jamie's death. But it had taken the combined efforts of his mother and the school and the city authorities to keep Troy from abandoning school altogether. Then, as soon as he had graduated, he had left Miami. Or rather, ran away. Away from what had happened and what might have been. For over two years he then wandered in a desultory manner throughout North America, a young, solitary black man, bereft of love and friendship, looking for something to overcome the feeling of emptiness that was his constant companion.

So I finally came to Key West, Troy would think, years later, as he settled back in his bed in the middle of the morning for a couple more hours of sleep. And for some reason made myself a home. Maybe it was just time. Or maybe I had learned enough to know that life goes on. But somehow, although the wound has never healed, I got past Jamie. And found the lost Troy. Or so I hope.

The dream that had been interrupted by the siren suddenly came back into his mind. Angie was beautiful in the moonlight in her white bathing suit. And now for some unfinished business, Troy laughed to himself, concentrating on the image of Angie as he returned to sleep.

2

"GOOD morning, angel," Troy said with a grand smile as Carol approached the Florida Queen. "Ready to do some fishing?" He hopped out of the boat and shouted at Nick, who was around at the back on the other side of the canopy. "She's here, Professor," he hollered "I'm going out to the parking lot to get

her stuff." Carol gave Troy the keys to her car and he took off in the direction of the marina office.

Carol paced for a few moments on the jetty before Nick emerged from behind the canopy. "Come on down on the boat," he said, scowling a little as he wiped some heavy dredging chain with a dark cloth. Nick felt terrible. He had a nasty hangover. And he was still bothered by the events of the night before Carol didn't say anything at first. Nick stopped cleaning the chain and waited for her to speak.

"I don't know exactly how to say this," she began in a firm but pleasant voice, "but it's important to me that I say it before I get on the boat." Carol cleared her throat. "Nick," she said deliberately, "I don't want to dive with you today. I want to dive with Troy."

Nick gave her a quizzical look. He was standing in the sun and his head was aching. "But Troy — " he began.

"I know what you're going to say," she interrupted him. "He doesn't have much experience and it could be a dangerous dive." She stared directly at Nick. "That doesn't matter to me. I have enough diving experience for both of us. I prefer to dive with Troy." She waited a few seconds. "Now if you're not willing — "

This time it was Nick who interrupted Carol. "All right, all right," he said, turning away. He was surprised to find that he was both hurt and angry. This woman is still pissed, he said to himself. And I thought maybe . . . Nick walked away from Carol and went back on the other side of the canopy to finish preparing the small rented salvage crane he and Troy had installed the night before. Since they had used this old equipment several times on other excursions, the installation had been straight forward and without major problems.

Carol climbed onto the boat and put her copy of the photos on top of the counter next to the steering wheel. "Where's the trident?" she called to Nick. "I thought I'd take another look at it this morning."

"Bottom left drawer, under the nav equipment," was his swift and sharp reply. She took the gray bag out of the drawer, opened it, and pulled out the golden trident. She held it by the long middle rod. It felt funny for some reason. Carol put the object back in the bag and pulled it out a second time. Again she held the heavy trident in her hands. It still didn't feel right. Carol remembered grasping the rod underneath the overhang in the water and wrapping her hand slowly around the central rod. That's it, she said to herself. It's thicker.

She turned the object over in her hands. What's the matter with me? she thought. Have I lost my mind? How could it he thicker? She examined it one more time with great care. This time she thought that the individual tines of the fork had lengthened and that she could detect a perceptible increase in the overall weight. Good grief. Can this be possible? she wondered.

Carol pulled out the photos she had brought along. All the images of the trident that she had with her had been taken underwater. But she was certain that she could discern two subtle changes since it was first photographed. The axis rod did appear to be thicker and the tines of the fork did indeed look longer.

"Nick," she said in a loud voice. "Nick, can you come here?"

"I'm right in the middle of something," an unfriendly voice responded from the other side of the canopy. "Is it important?"

"No. I mean yes," Carol answered. "But it can wait until your first available moment."

Carol's mind was racing. There are only two possibilities, she said to herself with logical precision, either it has changed or it hasn't. If it hasn't changed, then I must be spooked. For it definitely seems thicker. But

how could it change? Either on its own or someone changed it. But who? Nick? But how could he . . . ?

Nick came up to her. “Yes?” he said in a distant, almost hostile tone. He was obviously annoyed.

Carol handed him the trident. “Well?” she said, smiling and looking at him expectantly.

“Well, what?” he answered, totally confused by what was happening and still angry about the earlier interaction.

“Can you tell the difference?” Carol continued, nodding at the trident in his hand.

Nick turned it upside down as she had done. The sunlight glinted off the golden surface and hurt his eyes. He squinted. Then he switched the object from hand to hand and looked at it from many different angles. “I think I’m lost,” Nick said at length. “Are you trying to tell me that there’s some change in this thing?”

He held it out between them. “Yes,” she said. “Can’t you feel it? The central rod’s thicker than it was on Thursday and the tines or individual elements of that fork on one end are a little longer. And don’t you think the whole thing is heavier?”

Nick’s headache continued to throb. He looked back and forth between the trident and Carol. As far as he could tell, the object had not changed. “No, I don’t,” he said. “It seems the same to me.”

“You’re just being difficult,” Carol persisted, grabbing the trident back. “Here, look at the pictures. Check out the length of the fork there compared to the overall rod and then look at it now. It’s different.”

There was something in Carol’s general attitude that really irritated Nick. She always seemed to assume that she was right and everyone else was wrong. “This is absurd,” Nick nearly shouted in reply, “and I have a lot of work to do.” He paused for a moment and then continued. “How the hell could it change? It’s a metal object, for Christ’s sake. What do you think? That somehow it grew? Shit.”

He shook his head and started to walk away. After a couple of steps, he turned around. “You can’t trust the pictures anyway, “ he said in more measured tones . “Underwater photos always distort the objects . . .”

Troy was approaching with both the cart and Carol’s equipment. He could tell from the body positions, even without hearing the words, that his two boatmates were at it again. “My, my,” he said as he walked up, “I can’t leave you two alone for a minute. What are you fighting about this morning, Professor?”

“This supposedly intelligent reporter friend of yours,” Nick replied, looking at Carol and speaking in a patronizing manner, “insists that our trident has changed shape. Overnight I guess. Although she has not yet begun to explain how. Will you please, since she won’t believe me, explain to her about the index of refraction or whatever it is that fouls up underwater pictures.”

Carol appealed to Troy. “But it has changed. Honest. I remember clearly what it felt like at first and now it feels different.”

Troy was unloading the cart and putting the ocean telescope system on the Florida Queen. “Angel,” Troy said, stopping to check the trident that she was extending toward him with both hands, “I can’t tell whether it has changed or not, but I can tell you one thing. You were very excited when you found it the first time and you were also underwater. With that combination I wouldn’t trust my own memory of how something felt.”

Carol looked at the two men. She was going to pursue the discussion but Nick abruptly changed the subject. “Did you know, Mr. Jefferson, that our client Miss Dawson has requested your services as a diving partner today? She doesn’t want to dive with me.” His tone was now acerbic.

Troy looked at Carol with surprise. “That’s real nice, angel,” he said quietly, “but Nick is really the expert. I’m just a little more than a beginner.”

“I know that,” Carol responded brusquely, still chafing from the outcome of the previous conversation. “But I want to dive with someone I can trust. Someone who behaves responsibly. I know enough about diving for both of us.”

Nick gave Carol an angry look and then turned and walked away. He was pissed. “Come on, Jefferson,” he said. “I’ve already agreed to let Miss High and Mighty have her way. This time. Let’s get the boat ready and finish setting up that telescope thing of hers again.”

“My father finally divorced my mother when I was ten,” Carol was saying to Troy. They were sitting together in the deck chairs at the front of the boat. After they had gone over the procedures for the dive a couple of times, Carol had mentioned something about her first boating experience, a birthday on a fishing boat with her father when she was six, and the two of them had moved comfortably into a discussion of their childhood. “The breakup was awful.” She handed the can of Coke back to Troy. “I think you might have been luckier, in some ways, never to have known your father.”

“I doubt it,” Troy replied seriously. “From my earliest days, I resented the fact that some of the kids had two parents. My brother, Jamie, tried to help, of course, but there was only so much he could do. I purposely chose friends who had fathers living at home.” He laughed. “I remember one dark black kid named Willie Adams. His dad was at home all right, but he was an embarrassment to the family. He was an older man, nearing sixty at the time, and he didn’t work. He just sat on the front porch in his rocking chair all day and drank beer.

“Whenever I went over to Willie’s house to play, I would always find some excuse to spend a little time on the porch sitting next to Mr. Adams. Willie would fidget uncomfortably, unable to understand why I wanted to listen to his father tell his old, supposedly boring stories. Mr. Adams had been in the Korean War and he loved to tell about his friends and the battles and, particularly, the Korean women and what he called their tricks.

“Anyway, you could always tell when Mr. Adams was about to start one of his stories. His eyes would begin to stare in front of him, as if he were looking intently at something far off in the distance, and he would say, as much to himself as anybody, ‘Tell the truth, Baby Ruth.’ Then he would recite the story, almost as if he were quoting from a written book, ‘We had driven the North Koreans back to the Yalu and our battalion commander told us they were ready to surrender,’ he would say. “We were feeling good, talking about what we were all going to do when we got back to the States. But then the great yellow horde poured out of China . . .’ ”

Troy stopped. He stared out at the ocean. It was easy for Carol to see him as a young boy, sitting on a porch with his embarrassed friend Willie and listening to stories told by a man who lived hopelessly in the past but who, nevertheless, represented the father that Troy had never had. She leaned over to Troy and touched his forearm. “It makes a pretty picture,” she said. “You probably never knew how happy you made that man by listening to his stories.”

Around on the other side of the canopy, Nick Williams was sitting by himself in another deck chair. He was reading Madame Bovary and trying without success to ignore both his residual hangover and the scattered tidbits of conversation he was overhearing. He had programmed the navigation system to return automatically to the dive site from Thursday, so there was nothing else he really needed to do to pilot the boat. Nick almost certainly would have enjoyed sharing the conversation with Carol and Troy, but after his earlier confrontation with her, in which he felt she had made it clear that she didn’t

want to associate with him, he was not about to join them. It was now necessary that he ignore her. Otherwise she would conclude that he was just another wimp.

And besides, he liked his book. He was reading the part where Emma Bovary gives herself over completely to the affair with Rudolph Boulanger. Nick could see Emma sneaking away from her house in the small French provincial village and racing across the fields into the arms of her lover. Most of the time in the past, whenever Nick had read a novel about a beautiful, dark heroine, he had pictured Monique. But interestingly enough, the Emma Bovary that he was envisioning while he was reading on the boat was Carol Dawson. And more than once that morning, when Nick had read Flaubert's descriptions of the passions of Emma and Rudolph, he had imagined himself in the role of the bachelor from the French landed gentry making love to Emma/Carol.

The automatic navigation system that guided the boat while Nick was reading consisted of a simple transmitter/receiver combination and a small miniprocessor. Taking advantage of a worldwide set of synchronous satellites, software in the processor established the boat's location very precisely and then followed a preprogrammed steering algorithm to the desired final site. Along the way, the two-way link with the satellite overhead provided the necessary information to up date the path through the ocean.

When the Florida Queen was within a mile of the dive site, the nav system sounded a tone. Nick then went to the controls and changed to manual guidance. Carol and Troy rose from their chairs. "Remember," she said, "the primary purpose of our dive is to photograph and salvage whatever it was that we saw down in that fissure on Thursday. If we have enough time afterward, we will go back to the overhang where we found the trident."

Carol walked over and switched on the monitor attached to the ocean telescope. She was standing only a few feet away from Nick. They had not exchanged any words since right after the boat left Key West. "Good luck," he said quietly.

She looked at him to see whether he was serious or was being sarcastic. She couldn't tell. "Thank you," she said evenly.

Troy joined Carol at the monitor. She pulled the photographs out of the envelope so they could be used to define the exact spot to anchor. For a couple of minutes she issued instructions to Nick, based on what she was seeing from the telescope, commanding small corrections to the boat's position. At last the ocean floor underneath them looked almost exactly as it had on Thursday when they had seen the whales. With one major difference.

"Now where's that hole in the reef?" Troy said innocently. "I don't seem to be able to find it on the monitor."

Carol's heart was speeding as she glanced back and forth from the telescope screen to the photographs. Where is that fissure? she thought, It can't have disappeared. The boat drifted away from the dive site and Nick steered it back. This time Troy dropped the anchor overboard. But Carol still could not see any sign of the fissure. She could not understand it.

"Nick," she said finally, "could you give us a hand? We were down there together and we both saw the hole. Are Troy and I just confused in some way?"

Nick came over from the steering wheel under the canopy and stared into the monitor. He too was puzzled. But he thought he saw other things on the bottom of the ocean that also looked a little different. "I don't see the hole either," he said, "but maybe it's just the lighting. We were here in the afternoon last time and now it's ten in the morning."

Troy turned to Carol. "Maybe Nick ought to dive with you. He was there before, has seen the fissure, and knows how to find the overhang. Everything I know is from the pictures."

"No," said Carol quickly. "I want to dive with you. Nick's probably right. We just can't see the fissure because of the different lighting." She

picked up her underwater camera and walked around the canopy toward the back of the boat. “Let’s get going,” she said. “We’ll do just fine.”

Troy gave Nick a silent shrug, as if to say “I tried,” and followed her a few moments later.

3

“BUT Richard,” Ramirez said, “we could get into big trouble.”

“I don’t see how,” Lieutenant Todd replied. “Or why anybody ever has to know. The Navy built the system, after all, primarily for its own ships. We just allow everyone else to use it. All we have to do is interrogate the master register and get the Doppler and ranging time history for their particular identification code. Then we can figure out where they are. It’s easy. We do it all the time for our own vessels.”

“But we signed a maritime convention restricting our access to the private registers except in life-or-death or national security cases,” Ramirez continued. “I can’t just tap into the satellite files because you and I suspect a certain boat of being on an illegal mission. We need more authority.”

“Look, Roberto,” Todd argued vehemently, “who do you think is going to give us permission? We don’t have the photographs. We only have your word for it. No. We must act on our own. If we’re wrong, then nobody ever has to know about it. If we’re right, we’ll nail that bastard, we’ll both be heroes, and nobody will give us a hard time about what we’ve done.”

Ramirez was silent for a few seconds. “Don’t you at least think we should inform Commander Winters? He is, after all, the officer in charge of this Panther investigation.”

“Absolutely not,” said Lieutenant Todd quickly. “You heard him at the meeting yesterday. He thinks we’re out of line already. He’d like nothing better than to shit all over us. He’s jealous.” Todd saw that Ramirez was still undecided. “I’ll tell you what,” he said, “we’ll call him after we find out where the vessel is.”

Lieutenant Ramirez shook his head. “That won’t make any difference. We still will have exceeded our authority.”

“Shit,” said Todd in exasperation. “Tell me what has to be done and I’ll do it. Without you. I’ll take all the risk.” He stopped and looked directly at Ramirez. “I can’t fucking understand it. I guess you Mexicans really are gutless. You’re the one who actually saw the missile in the photograph, but . . .”

Ramirez’s eyes narrowed. His voice became hard. “That’s enough, Todd. We’ll get the data. But if this turns out to be a disaster, I will personally break your neck with my own hands.”

“I knew you’d see it my way,” Lieutenant Todd replied, smiling as he followed Ramirez to a command console.

Commander Winters put the extra six-pack of Coke on the top of the ice and then closed the cooler. “Anything else,” he shouted out the door at his wife and son, “before I haul this thing out to the car?”

“No, sir,” was the reply from the driveway. The commander picked up the cooler and carried it through the screen door. “Whew,” he said, as he loaded it in the open trunk of the car, “you have enough food and drink in here for a dozen people.”

“I wish you were coming, sir,” said Hap. “Most of the rest of the fathers will be there.”

“I know. I know,” answered Winters. “But your mother’s going. And I need to do some private rehearsing for tonight.” He gave his son a brief hug. “Besides, Hap, we’ve talked about this before. Lately I haven’t felt

comfortable at organized church activities. I believe that religion is between God and the individual."

"You haven't always felt that way," Betty interjected from the other side of the car. "In fact, you used to love church picnics. You'd play softball and swim and we would laugh all evening." There was just a trace of bitterness in her voice. "Come on, Hap." she said after a momentary pause "We don't want to be late. Thank your father for helping us pack."

"Thanks, Dad." Hap climbed into the car and Winters closed the door behind him. They waved to each other as the Pontiac backed out of the driveway into the street. As they drove away, Winters mused to himself, I must spend more time with him. He needs me now. If I don't it will soon be too late.

He turned around and walked back into the house. At the refrigerator he stopped and opened the door. He poured himself a glass of orange juice. While he was drinking it, he looked idly around the kitchen. Already Betty had cleaned up the breakfast dishes and put them in the dishwasher. The counters were scrubbed. The morning paper was neatly folded on the breakfast table. The kitchen was tidy, orderly. Like his wife. She abhorred messes of all kinds. Winters remembered one morning, back when Hap was still in diapers and they were living in Norfolk Virginia. The little boy had been exuberantly pounding the kitchen table and suddenly his arms had flailed out, knocking Betty's cup of coffee and the creamer onto the floor. They both broke and made quite a mess all over the kitchen. Betty had stopped her meal abruptly. By the time she had returned to her cold scrambled eggs, there was not the slightest indication anywhere, not on the floors, the lower cupboard, or even in the wastebasket (she packed all the broken pieces neatly in the basket liner and then removed the entire bag to the outside cans), that there had been an accident.

Just to the right of the refrigerator in the Winterses' kitchen, hanging on the wall, there was a small plaque with simple lettering. "For God so loved the world," it said, "that He gave His only begotten son, that whosoever shall believe in Him shall have everlasting life . . . John 3:16." Vernon Winters saw this kitchen plaque every day, but he had not actually read the words for months, maybe even years. On this particular Saturday morning he read them and was moved. He thought about Betty's God, a God very similar to the one he had worshipped in his childhood and adolescence in Indiana, a quiet, calm, wise old man who sat up in heaven somewhere, watching everything, knowing everything, waiting to receive and answer our prayers. It was such a simple, beautiful image. "Our Father, Who art in Heaven," he said, recalling the hundreds maybe thousands of times that he had prayed in church, "Hallowed be thy name. Thy kingdom come. Thy will be done. On Earth as it is in Heaven . . ."

And what is Thy will for me, old man, Winters thought, a little taken aback by his own irreverence. For eight years You have let me drift. Ignored me. Tested me like Job. Or maybe punished me. He walked over to the kitchen table and sat down. He took another sip from his orange juice. But have I been forgiven? I don't yet know. Never once in all that time have You given me a definite sign. Despite my prayers and my tears. One time, he thought, right after Libya, I wondered if maybe . . .

He remembered being half asleep on the beach, lying on his back with his eyes closed on a big comfortable towel. In the distance he could hear the surf and children's voices, occasionally he could even distinguish Hap's voice or Betty's. The summer sun was warm, relaxing. A light began to dart about on the inside of his eyelids. Winters opened his eyes. He couldn't see much because the sunlight was too bright and there was also a glare, a metal glint of some kind, in his eyes. He shaded his forehead with his hand. A little girl with long hair, a year old perhaps, was standing just above him, staring at him. The glint was coming from the long metal comb in her hair.

Winters closed his eyes and opened them again. Now he could see her better. She had shifted her head just a little so the glare was gone. But she

was still staring fixedly at him, with absolutely no expression on her face. She was wearing only diapers. He could tell that she was foreign. Arab perhaps, he had thought at the time, looking back into her deep brown, almond-shaped eyes. She didn't move or say anything. She just watched him, curious, relentless, without seeming to notice anything that he did.

"Hello," Winters said quietly. "Who are you?"

The little Arab girl gave no sign that she had heard anything. After a few seconds, however, she suddenly pointed her finger at him and her face looked angry. Winters shuddered and sat up abruptly. His quick action frightened her and she began to cry He reached for her but she pulled away, slipped, lost her balance, and fell on the sand. Her head hit something sharp when she fell and blood started running down her scalp and onto her shoulder. Terrified, first by the fall and then by the sight of her own blood, the little girl began to wail.

Winters hovered over her, struggling with his own panic as he watched the blood splatter the sand. Something unrecognized flashed through his mind and he decided to pick the little Arab girl up to comfort her. She fought him violently, with the reckless abandon and surprising strength of the toddler, and struggled free. She fell again on the sand, on her side, the blood from her scalp injury scattering drops of red around the light brown sand. She was now completely hysterical, crying so hard she often could not catch her breath, her face suffused with fear and anger. She pointed again at Winters.

Within seconds a pair of dark brown arms swooped out of the sky and picked her up. For the first time Winters noticed that there were other people around, lots of them in fact. The little girl had been picked up by a man who must have been her father, a short, squat Arab man in his mid-twenties wearing a bright blue bathing suit. He was holding his daughter protectively, looking as if he were expecting a fight, and consoling his distraught young wife whose sobs intermingled with the little girl's frantic cries. Both the parents were looking at Winters accusingly. The mother daubed at the little girl's bleeding head with a towel.

"I didn't mean to hurt her," Winters said, recognizing as he spoke that what he said would be misinterpreted. "She fell and hit her head on something and I . . ." The Arab couple were backing away slowly. Winters turned to the others, maybe a dozen people who had come over in response to the little girl's cries. They also were looking at him strangely. "I didn't mean to hurt her," he repeated in a loud voice. "I was just . . ." He stopped himself. Big tears were falling off his face and onto the sand. My God, he thought, I'm crying. No wonder these people . . .

He heard another cry. Betty and Hap had apparently just walked up behind him as the Arab couple had backed away with their bleeding daughter. Now, having seen the blood on his father's hands, five-year-old Hap had broken into tears and buried his face in his mother's hip. He sobbed and sobbed. Winters looked at his hands, then at the people standing around him. Impulsively he bent down and tried to clean his hands in the sand. The sound of his son's sobbing punctuated his vain attempt to wipe his hands free of the blood.

As he was kneeling in the sand, Commander Winters glanced at his wife Betty for the first time since the incident had started. What he saw on her face was abject horror. He entreated her for support with his eyes, but instead her eyes glazed over and she too fell to her knees, careful not to disturb her tearful son who was clinging to her side. And Betty began to pray. "Dear God," she said with her eyes closed.

The crowd dispersed slowly, several of them going over to the Arab family to see if they could be of any help. Winters stayed on his knees in the sand, shaken by his own actions.

At length Betty stood up. "There, there," she consoled her son Hap, "everything will be all right." Without saying another word, she carefully

picked up the beach bag and towels and started walking toward the parking lot. The commander followed.

They left the beach and drove back to Norfolk where they were living. And she never asked about it, Winters thought, as he sat at his kitchen table eight years later. She wouldn't even let me talk about it. For at least three years. It was as if it had never happened. Now she mentions it once in a blue moon. But we still have never discussed it.

He finished his orange juice and lit a cigarette. As he did so, he thought immediately of Tiffani and the night before. Fear and arousal simultaneously stirred in Winters when he thought of the coming evening. He also found that he had a curious desire to pray. And now dear God, he said tentatively, are You testing me again? He was suddenly aware of his own anger. Or are You laughing at me? Maybe it wasn't enough for You to forsake me, to leave me adrift. Maybe You won't he satisfied until I am humiliated.

Again he felt like crying. But he resisted. Winters crushed out his cigarette and stood up from the table. He walked over to the side of the refrigerator and pulled the plaque containing the Bible verse off the wall. He started to throw it in the trash but, after hesitating for a second, he changed his mind and put it in one of the kitchen drawers.

4

CAROL was swimming rapidly about six feet above the trench as they approached the final turn. She took a few photographs while she waited for Troy to catch up, pointed down below her to where the tracks turned to the left, and then started swimming again, more slowly this time, following the tracks in the narrow crevice toward the overhang. Nothing here had changed. She motioned for Troy to stay back and swam down into the trench, carefully, as she had done before when she was with Nick. Her search of the area under the overhang was very thorough. She did not find anything.

She gestured to Troy that nothing was there, and then, after another quick sequence of photographs, the two divers began retracing their path, going back along the tracks toward the area under the boat where they had already spent fifteen minutes earlier searching fruitlessly for the fissure they had seen on Thursday. It had mysteriously vanished. All the tracks, although somewhat eroded, still converged in front of the reef structure where the hole had been just two days before. Carol had poked and prodded, even damaged the reef in several places (which, as an environmentalist, she hated to do, but she was certain the hole had to be there), but had not found the fissure. If Troy had not seen it so clearly, first on the ocean telescope monitor and then in the pictures, he would have thought that it was just a figment of Nick and Carol's collective imagination.

As Carol, deep in her thoughts, turned right over the main trench after leaving the side path that had led to the overhang, she was careless and brushed ever so slightly against a crop of coral that was extending outward from the reef. She felt a sting on her hand. She looked down and saw that she was bleeding. That's funny, she thought, I just barely touched it. Her mind flashed back to ten minutes before, when she had been roughly pushing the coral and kelp aside in search of the fissure. And I wasn't even scratched . . .

A wild, inchoate idea started forming in her mind. Excited now, she intensified her swimming down the long trench where the fissure had been. Troy could not keep up with her. It was a long swim but Carol completed it in about four or five minutes. She checked her regulator pressure as she waited for her diving partner. They exchanged the thumbs-up sign when he arrived and Carol tried. without success, to explain her idea to Troy using hand signals. Finally, she bravely reached out and grabbed a piece of coral with her hand.

Carol saw Troy's eyes open wide and his face grimace behind his mask. She opened her hard. There were no cuts, no scrapes, no blood. Astounded, Troy swam over beside her to look at the coral colony she had just disturbed. He too could touch and even hold this strange coral without cutting his hand. What was going on?

Carol was now pulling the coral and kelp away from the reef. Troy watched in amazement as a huge segment of the reef structure seemed to peel off, almost like a blanket . . .

They heard the great WHOOSH only milliseconds before they felt the pull. A giant chasm opened in the reef behind them and everything in the area, Troy, Carol, schools of fish, plants of all kinds, and an enormous volume of water, was swept into the hole. The current was very swift but the channel was not too large, for Carol and Troy bounced against what felt like metallic sides a couple of times. There was no time to think. They were carried along, as if on a water slide, and simply had to wait for the ride to be over.

The dark gave way to a deep dusk and the current slowed markedly. Separated by about twenty feet, Carol and Troy each tried to gather his wits and figure out what was happening. They appeared to be in the outer annulus of a large circular tank and were going around and around, passing gates of some kind after every ninety degrees of revolution. The water in the tank was about ten feet deep. Carol rolled on her back and looked up. She could see a lot of large structures above her, some of them moving, that seemed to be made out of metal or plastic. She could not see Troy anywhere. She tried to grab the sides of the tank so she could stop and look for him. It was useless. She could not resist the motion of the current.

They made three or four trips around the circle without seeing each other. Troy noticed that all the fish and plants had slowly disappeared from their annulus, suggesting that some kind of sorting process was underway. Suddenly the current increased and he was pitched forward and down, under the water and then through a half-open gate, into darkness again. Just as a trace of light appeared above the water and the rate of flow again slowed, he felt something clamp on to his right arm.

Troy was lifted out of the water a foot or so. In the dim light he couldn't see exactly what it was that had caught him, but it felt very strong. It held him without additional movement. Troy looked behind him in the current, where he had been, and he saw Carol's tumbling body approaching. With his free left arm he grabbed at her. She felt his arm and immediately wrapped herself around it. She composed herself, lifted her head out of the water, and struggled to reach the trunk of Troy's body. She succeeded in holding tight to him as the current rushed past. She caught her breath and for just a moment their eyes met behind their diving masks.

Then, inexplicably, the clamp released. When they were back in the water, the current did not seem so strong. They were able to hold on to each other without much difficulty. After about fifteen seconds, the flow of the water slowed down altogether. They had been deposited in a pool in what appeared to be a large room and the water was draining out, running into some unseen orifice at the far end of the room. The last of the water disappeared. Shaken and exhausted Carol and Troy started to stand up in their diving gear.

Carol had great difficulty getting to her feet. Troy helped her up and then pointed to his regulator. Ever so slowly, he slipped out of his mouthpiece and sampled the ambient environment. One breath, then another. As far as he could tell, he was breathing normal air. He shrugged his shoulders at Carol and, in a fit of bravado, took off his mask as well. "Hellooo," he shouted nervously, "Anybody there? You have guests out here."

Carol slowly removed both her mask and her regulator. She had a dazed look on her face. The two of them looked around. The ceiling was about ten feet above them. Overall the dimensions of the chamber were roughly equivalent

to a large living room in a nice suburban home. The walls, however, were quite unusual. Instead of being flat and forming nice right-angle joints at each of the intersections, the walls were made of large, curved surfaces, some concave and some convex, that were alternately colored red and blue. Without thinking, Carol began walking around, slowly of course because of the bulky diving gear, and taking photographs.

"Uh, just a moment, Miss Dawson," Troy said with a hesitant smile. He pulled off his flippers and followed her. "Before you take any more pictures, angel, would you kindly tell this unsophisticated black boy just where in the fuck he is? I mean, last I knew, I was going down under the boat to look for a hole. I think I found it, but I must say it's a trifle unnerving to be visiting someone and not know just who it is. So could you stop with the journalism bit for just a minute and tell me why you are so calm."

Carol was right in front of one of the concave blue wall panels. There were two or three indentations in the wall structure, at about eye level, that formed circles or ellipses. "Now what do you suppose this is?" Carol wondered aloud. Her voice sounded flat, as if she were far away.

"Carol," Troy almost shouted. "Stop it. Stop right now. We can't just blissfully walk around here as if this is a typical afternoon stroll through a model house. We have to talk. Where are we? How are we going; to get out and go home? Home, remember the place? I guarantee you it's not under the ocean two hours away from shore." He grabbed her by the shoulders and shook her.

She started to snap out of her daze. She looked slowly around the entire room and then back at Troy. "Jesus," she said. "And shit." He saw her tremble a little and stepped forward to hug her. She indicated for him to leave her alone. "I'm all right. At least almost." Carol took a couple of deep breaths and then smiled. "Anyway, I've sure got one hell of a story here." She looked around the room again. "Uh Troy," she said with her brow wrinkled, "how did we get in here? I don't see a doorway or an opening or anything."

"Good question," Troy replied. "A very good question, to which I might have the answer. I think these crazy colored walls move around. I believe I saw the walls rolling into place when I was under the water. So all we have to do is push them aside and find our way out." He tried to wedge his hands into a crack that was a connection between a red and a blue piece of the wall structure. He was unsuccessful.

Carol left Troy and started to pace around the perimeter of the room in her ungainly diving apparatus. She quickly stopped and took off everything except her bathing suit. She seemed intent on both examining and photographing every single panel in the wall. Troy took off his own air tanks and buoyancy vest as well, dropping them on the light metal floor with a clank. He watched her for a minute.

"Carol, oh Carol," he said from across the room, a big fake grin spreading across his face. "Would you like to tell me what you're doing now? I mean, after all, angel, I may be able to help."

"I'm looking for something that says 'Eat Me' or 'Drink Me,' " she replied with a nervous laugh.

"Of course," Troy mumbled to himself, "that was absolutely obvious."

"Do you remember Alice in Wonderland?" Carol asked from the opposite side of the room. She had found a long, thin protuberance that looked like a handle sticking out from the center of one of the red panels. She waved and he came over. The two of them tried to twist and turn the handle. Nothing happened. Carol became frustrated struggling with it.

Troy thought he saw a first sign of panic in Carol as her eyes frantically scanned the rest of the room. He pulled himself up and stood at attention, military style. "Speak roughly to your little boy . . . And beat him when he sneezes . . . He only does it to annoy . . because he knows it teases."

The deep furrows in Carol's face showed that she thought Troy had temporarily lost his mind. "That was the Queen of Hearts, I think." Troy laughed. "I'm not sure exactly. But I had to learn it for a play when I was in the fifth grade." Carol had relaxed and was also laughing in spite of her fear. She reached up and gave Troy a kiss on the cheek. "Careful, now, careful," he said with a twinkle in his eye. "We black men are easily aroused."

Carol slid her arm through Troy's as they finished walking around the rest of the room, searching the walls for any sign of an exit Troy's banter made Carol feel comfortable. "When I was in the eighth grade a black teacher of mine told me that Alice was a racist story. He contended that it was very significant that it was a white rabbit that Alice followed. He said that no nice little white girl would ever have pursued a black rabbit down a hole." He stopped in front of another red panel. "Well, well," he said. "What have we here?"

This red panel looked just like the rest of the wall from a distance. But up close, within a range of a couple of feet or so, all kinds of patterns, made with small white dots, could be seen stippled on top of the red paint. An array of consecutive rectangular sections outlined by the white dots high-lighted the center of the panel "Hey, angel," Troy said, pushing on the sections at random, "don't you think this looks suspiciously like a keyboard?" Troy began to push on the keys at random. Carol joined him. It became a game. The two of them stood at the red panel for almost a minute, putting their fingers into every outlined section and pushing hard.

Suddenly Carol backed away from the panel, turned around, and started walking directly across the room. "Where are you going?" yelled Troy, as Carol, spinning around to answer, nearly stumbled over her diving gear on the floor.

"I have a crazy idea," called Carol. "Call it feminine intuition. Call it psychic if you will." She had reached the red panel where they had struggled with the handle. Now she pulled it down easily and immediately heard a creak. She jumped back, startled, as the entire panel folded back and away from her, revealing a dark opening large enough for a truck to enter. Troy came over beside her and the two of them stared into the void.

"Holy shit," he said "Are we supposed to go in there?"

Carol nodded. "I'm certain we are."

Troy looked at her with a curious expression. "And just how do you know that?"

"Because it's the only way out of here," Carol replied.

Troy cast one final glance around the strange room with the curved and colored walls. There was an indisputable logic to what Carol had said. He took a deep breath, held Carol's hand, and walked into the black tunnel.

Behind them they could barely see the small shaft of light coming from the room where they had left their diving gear. Inside the pitch-black hallway they moved very slowly, cautiously. Troy kept one hand on the wall and the other clenched around Carol's. The sound of their labored breathing, heightened by the constant fear and apprehension, reverberated off the rounded walls. They didn't talk. Twice Troy had started to sing a few lines from a popular song, to assuage his own disquiet, but both times Carol stopped him. She wanted to be able to hear in case there were any other noises.

At one point she squeezed his hand and stopped. "Listen," she said in a whisper. Troy held his breath. There was utter silence, except for something very soft that he couldn't quite identify, way off in the distance. "Music," Carol said. "I think I hear music."

Troy strained to identify the sound just below the threshold of his hearing. It was useless. He pulled on Carol's hand. "It's probably inside your head," he said. "Let's go."

They had made a turn and the light behind them had disappeared. Altogether they had been in the tunnel for about ten minutes. Carol was becoming despondent. “What if this doesn’t go anywhere?” she asked Troy.

“That doesn’t make any sense,” he replied quickly. “Somebody built it for some purpose. It’s obviously a connecting passageway.” He fell silent.

“Who built it?” Carol asked the question that had been troubling both of them during the long tense walk down the dark hallway.

“Another good question,” Troy replied. He hesitated just a minute before continuing with his answer. “My guess is the United States Navy. I think we’re in some kind of top-secret underwater laboratory that nobody knows about.” Of course, he thought, not saying it out loud because he didn’t want to disturb Carol, it could also be Russian. In which case we are in deep shit. If the Russians have a large, secret laboratory this close to Key West, they are not going to be happy . . .

“Look, Troy,” Carol said excitedly. “I see a light. There is somebody here after all.” The tunnel was about to split into two pans. At the end of one of the two forks, the one sharply to the left, a patch of illumination could clearly be seen. Still holding hands, Troy and Carol walked briskly toward the light. Troy was aware that his heart was beating very rapidly

Carol almost raced into the new room. She had expected that they were about to be found, that this mysterious adventure was now going to end and everything would be explained. Instead, as she looked around her in a small, oval chamber with the same bizarre panels for walls (except these were colored brown and white, instead of red and blue as in the previous room), she felt a tremendous confusion. “What is this place?” she asked Troy. “And how are we going to get out?”

Troy was standing in the center of the room with his head tilted back as far as it would go. He was staring up at a vast arched ceiling some thirty to thirty-five feet above them. “Wow,” he exclaimed, “this is one huge place.” The muted light illuminating the room was coming from slabs of partially translucent material, possibly glass crystals, that were embedded in the ceiling.

The brown and white panels forming the walls for the particular room they had entered were only ten feet high, but they were high enough to prevent Carol and Troy from seeing out. They had a strange sense of both freedom and confinement. On the one hand, first the tunnel and now this small room, the size of a child’s bedroom in a small house, had made them feel claustrophobic; however, the sense of space conveyed by the cathedral ceilings was liberating.

“Well?” asked Carol, somewhat impatiently, after waiting a few moments while Troy walked around and surveyed the room. He was observing that the brown and white wall panels were only slightly curved and were thus much closer to normal walls than those in the initial room had been.

“I’m sorry, angel,” he replied, “I forgot the question.”

She shook her head. “There is only one question, Mr. Jefferson. I believe that you asked it of me on our last tour stop.” She looked at her watch. “In about fifteen minutes, we will have exceeded the maximum time for our air supply. Unless I miss my guess, our friend Nick is probably starting to worry right now. But we still have no idea . . . What are you doing?”

She interrupted herself when Troy bent down to pull a small knob on one of the brown panels in the corner of the room. “These are drawers, angel,” he said, as the bottom part of the panel came out several inches from the wall. “Like a dresser.” He opened a second drawer above the first. “And they have something in them.”

Carol came over to see. She reached into the second drawer that Troy had opened and pulled out a rust-colored sphere about the size of a tennis ball. The surface of the ball was very curious. Instead of being smooth and regular, it had grooves cut into it, mostly on one side, and tiny bumps, like those on

the surface of a pickle, around and next to the grooves. In other places there were poorly defined indentations as well. Carol examined the sphere in the weak light. “I’ve seen something like this before,” she said. “But where?” She thought for a few seconds. “I’ve got it,” she announced, pleased that her memory had come through, “this looks exactly like the model of Mars in the National Air and Space Museum.”

“Then I must have the Earth,” Troy replied, showing her a mostly blue sphere the size of a softball that he had removed from the top drawer. The two of them stood together in the dim light, looking back and forth at the spheres they were holding in their hands. “Shit,” Troy shouted eventually, spinning around and looking at the ceiling. “And double shit. Whoever you are, we’ve had enough. Come out now and identify yourself.”

A partial echo of his voice came back to them. Otherwise they heard nothing. Anxious to be doing something, Carol continued her search of the room. She found another group of three drawers in a nearby brown panel. While she was opening the first of these, Troy playfully hurled his blue ball at what appeared to be an exit, a dark opening between panels on the other side of the room. The sphere hit a white panel near the exit with a thunk and started to fall to the floor. However, just before it touched the ground, the sphere lifted up, as if pulled somehow from above, and stopped in the center of the room about five feet above the floor. It began to spin.

Troy’s eyes opened wide. He walked over to the sphere and placed his hand between the ball and high ceiling, trying to find the strings. Nothing happened. The Earth sphere continued to spin slowly and inscribe a circle in the air in the middle of the room. Troy pushed the ball lightly. It moved in response to his push, but after his applied force was removed and the effect had dissipated, the sphere returned to its previous location and continued its earlier movement. Troy turned around. Carol had her back to him and was searching unsuccessfully for another set of drawers. The Mars ball was still in her left hand.

“Uh, Carol,” Troy said slowly. “Would you mind coming over here a moment?”

“Certainly,” she replied without looking. “Jesus, Troy, these drawers are full of all kinds . . .” She had turned around and now noticed the Earth sphere hovering in the air near the center of the room. Her brow knitted. “That’s cute,” she said tentatively, “real cute. I didn’t know you were a magician as well.” Her voice trailed off. She could see the perplexed expression on Troy’s face. She walked over next to him to have a closer look.

The two of them stood silently for at least ten seconds as they watched the blue softball slowly spin in the air. Next Troy took the Mars sphere from Carol and tossed it, under-handed, up toward the high ceiling. It arched up and fell down normally, until it was just above the floor. Then, like the blue sphere before it, the Mars ball developed its own sense of direction and momentum. It floated up about five feet off the floor, began to spin slowly, and hovered in the air next to the blue sphere representing the Earth.

Carol grabbed Troy’s hand. She shivered and then regained her composure. “There’s something about this that gives me the willies,” she said. “All in all, I would deal better with a caterpillar asking me, ‘Who are you?’ At least in that case I would have some idea what I’m up against.”

Troy turned around and led Carol back over to the partially opened drawers. “I ran into this old bearded dude once when I was hitchhiking,” he began, as he pulled out a basketball that was covered with latitudinal belts and bands in shades of red and orange. He aimlessly tossed the big Jupiter ball over his shoulder, using both hands. Carol watched it, still fascinated, as it joined the other two spheres orbiting around an empty focus in the middle of the room.

“He was driving an old run-down pickup truck and smoking a joint. At first we talked a little. He would ask me questions and I would start to give an answer. But after a sentence or two, he would interrupt me and say, ‘You don’t know shit, man.’ That was his response to everything.”

Troy methodically emptied all six of the drawers while he was telling his story. He threw all the objects he found into the center of the room. A few of them he watched, casually, as if he were witnessing an everyday occurrence. Each of the new spheres repeated the earlier pattern. A nearly complete working model of the solar system was forming about five feet above the f1oor.

“Finally I grew tired of his game and was quiet. We drove along for miles in silence. It was a clear and beautiful night and he kept hanging his head out the window to look at the stars. Once, when he pulled his head back in, he lit another joint, handed it to me, and pointed back out the window at the stars. ‘They know, man, they know,’ he said. Miles later, when he let me out of the truck, he leaned over and I could see the wildness in his eyes. ‘Remember, man,’ he whispered, ‘you don’t know shit. But they know.’ ”

As Troy finished the tale, Carol came over beside him and pulled out two handfuls of tiny fragments from the final drawer. They were a little sticky to the touch. She shook them off her hands and they miraculously flew around the room and coalesced into the ring systems of Saturn and Uranus. She looked at Troy in awe.

“Does that bizarre story have a point?” Carol asked. “I must admit that I am amazed at how nonchalant you are about this whole damn thing. For myself, I’m just about ready to freak out. Completely.”

Troy pointed at the miniature planets floating in the air. “What we are seeing has no explanation in terms of our experience. We’ve either died together or transferred to a new dimension or someone is playing mind games with us.” He smiled at Carol. “If you must know, angel, I’m scared absolutely shitless. But like that old stoned hippie, I keep telling myself, ‘They know.’ Somehow it gives me comfort.”

They heard a soft sliding sound and a shaft of bright light burst into the room from an opening that was forming between two panels, one brown and one white, just to the right of the exit. Carol recoiled automatically and covered her eyes for an instant. Troy also jumped back at first, but then shaded his eyes with his hands and watched. The panels continued to slide until an opening about two feet wide had developed. The room was beginning to fill with light. Troy saw a great illuminated ball coming slowly through the opening. “Here comes the Sun Doot-un-Doo-Doo Doo . . . Here comes the Sun,” he sang anxiously, “And I say . . . it’s all right . . .” He hummed a few more bars of the song as Carol opened her eyes.

“Jesus,” she said. The bright orb, the size of a giant beach ball, lifted itself into its proper place in the orrery and flooded the entire room with its radiance. The spinning, orbiting planets shone with reflected light from their sides facing the Sun. Carol stood transfixed, silent tears running down her face. She could not speak or move. She was completely overwhelmed.

Troy was also frightened, but not yet so much that his ability to function was impaired. However, a moment later he saw something in the exit that sent a bolt of terror through his system. His heart surged into overdrive as he blinked and then squinted, making certain his mind was not playing tricks on him as he looked just around the bright light of the model Sun. Instinctively, he turned to protect Carol and shielded her from what he had just seen.

“Don’t look now,” he whispered, “but we have a visitor.”

“What?” said Carol, confused and still stunned.

Troy held her by the arms and they moved together several steps to the right. He looked over his own shoulder and saw the thing again.

“Over by the exit,” he said, turning around, unable any longer to hide his panic.

Carol’s eyes indicated that she had found the source of Troy’s terror. She had no idea what it was, but she could see that it was large, clearly threatening, and absolutely different from anything that she had ever seen or imagined. It had also moved into the room. She heard Troy’s frantic, incoherent shouts, but their meaning didn’t register. She looked at the thing again and her mind balked. She opened her mouth to scream. Nothing came out at first. She dropped to her knees on the floor. She heard the sound of screams in her ear, but they seemed far, far away. Her brain was sending a message that said, ‘You’re screaming,’ but for some reason it didn’t seem possible. It had to be someone else.

The thing was coming toward her Its main body was about eight feet tall at that moment, but it was continually changing its shape and size as it undulated across the room. Whatever it was, Troy and Carol could see into it and even through parts of its structure. A transparent external boundary membrane was wrapped around a permanently seething set of mostly clear fluid matter that ebbed and flowed with each movement. The thing moved like an amoeba, matter simply heading in the right direction, but with astonishing speed. Tiny black dots were scattered just behind all its external surfaces, darting in all directions, apparently supervising the continuous reconfigurations that gave it motion. A half dozen chunks of grayish, opaque matter, objects a foot or so square, were also embedded near the center of the primary body.

But it was not the main body of the thing that was so terrifying. Protruding from its upper portions was a frightening array of a dozen appendages, mostly long and slender in shape, that appeared to be stuck into the main body like sharp objects in a pin cushion. It looked as if the large, clear, amoebalike structure was a versatile transportation system that could carry virtually anything and that the payload, at least for this usage, was this family of constantly active rods, all of which were threatening because their end effectors resembled needles, hands, brushes, teeth, and even swords and guns. In Carol’s mind, she was being attacked by a heavily armored tank that could change size in an instant and move on invisible treads in any direction.

Troy moved to the side, trying to calm his fear and catch his breath, as he watched the thing zero in on Carol. Its longest attachment, a reddish plastic implement which split into two short tines about a foot away from the primary body, suddenly extended itself outward an additional three feet and stopped just six inches in front of Carol’s eyes. She screamed and pushed it away, forcefully, but it popped right back into position. Troy plucked the Jupiter ball out of the air and, with all his might, hurled the sphere at the center of the thing. The shapeless mass fell back on impact and immediately retracted its extended appendages. But in an instant the thing reconfigured itself somehow and adjusted its matter to let the ball pass completely through. Before it hit the floor on the other side, Jupiter rose into the air and came back to take its proper position in the solar system model.

The thing had now stopped advancing toward Carol. It was sitting in the middle of the room, its spindly appendages flailing around in all directions. It seemed to be making a decision. Troy bravely grabbed a rod with an end effector like a brush and tried to pull it away from the main structure. Instantly, core clear material flowed into the joint where that particular rod was attached, strengthening the connection. But Troy’s action definitely caused a change in its pattern. The thing started after him. Ever so carefully, making sure it would follow him while watching out for another quick extension of the red implement with the two tines, Troy edged toward the exit. As the thing continued to move toward him, Troy motioned for Carol to get back. Then he broke for the door, tripping slightly over an extended rod on his way out.

It hardly hesitated. With surprising celerity the thing made itself short and squat. A maximum amount of exposed surface was now on the floor and it could move more quickly and efficiently. The deployed group of attachments were

placed into some kind of compact traveling configuration and the thing hustled out the door.

Carol was left alone on her knees on the floor. The solar system model was above her and to the right. For over a minute she didn't move. She just watched the spinning planets abstractedly and listened for the occasional sound of Troy's footfalls in the distance. At length there was a long period of silence and Carol rose to her feet. She took several small, slow steps, reassuring herself that she was all right, and then walked over to the exit opening between the panels. The exit opened onto a corridor that ran in both directions.

Troy had gone to the right when he had left the room. After remembering her camera and going back to take a few quick photographs of the suspended planets, Carol followed Troy's path, also taking the corridor to the right. She walked slowly down the black hall, turning around frequently to locate the light coming from the room that she had just left. There was now a close ceiling over her head. The hall next split into two forks; both directions were dark. Carol listened for sounds. Again she thought she heard music, but she couldn't begin to identify where it was coming from.

This time she chose the left fork in the hallway. Soon it narrowed and seemed to be circling back in the direction from which she had just come. She was just about to turn around and retrace her steps when she distinctly heard two noises, something like a thud followed by a scraping sound, off to the right in front of her. Drawing her breath slowly and struggling to conquer her fear, Carol moved forward in the dark. After about twenty more feet she came upon a low door that opened to the right. She bent down slightly and peered in. In the dusky light she saw unusual shapes and structures in another small room with walls made of the now familiar curved and colored panels. She crawled through the doorway and stood up.

Soft local lights located in a few of the wall panels came on as soon as Carol's feet contacted the floor in the room. Her arrival also triggered two or three notes from some kind of musical instrument. It sounded like an organ and was apparently way off in the distance in another part of the cathedral area enclosed by the vast arched ceilings that were again above her. She stopped, surprised. She stood still for several seconds. Then, without moving, Carol carefully surveyed her new surroundings.

In this room the wall panels were very bright, alternating between purple and gold, and they were extremely curved. Along with Carol in the room there were three objects of unknown purpose. One looked like a writing table, a second like a long, low bench that was wide at one end and tapered to a point at the other, and the third resembled a very tall telephone pole whose top and bottom were connected by sixteen thin strings stretched out and around a broad ring about one third of the way down the pole.

Carol could walk between the thin strings. The ring, made out of a gold metallic material, was a couple of feet above her head, almost at the level of the top of the wall panels. She grabbed one of the strings and felt it vibrate. It made a muffled, flat sound. She backed away from the string and tried to pluck it. A note sounded, very lyrical, like a heavy harp. Carol realized she was standing inside a musical instrument. But how to play it? She spent a few minutes wandering around the room, trying without success to find the equivalent of a bow. She knew it would be impossible to play the harp if she had to run around and pluck each individual string herself.

She walked over to the writing table. She quickly figured out that it was also a musical instrument. It looked much more promising. There were indentations in the table, sixty-four altogether, set up in eight rows and eight columns. Pressing each key produced a different sound. Although Carol had taken five years of piano lessons as a small child, it was a difficult chore, at first, for her even to play "Silent Night" on the strange writing table. She

had to correlate the sounds made by pressing the individual keys with the notes and chords that she remembered from her childhood. While she was teaching herself to play the instrument, she stopped often to listen to the delicate, crystal sound that it made. It reminded her mostly of a xylophone.

Carol stood at the table for several minutes. Eventually she played an entire verse of "Silent Night" without making a single mistake. Carol smiled, pleased with herself, and relaxed momentarily. During this interlude the great organ in the distance (which she had heard briefly when she had entered the room and could now pinpoint as being somewhere in the upper reaches of the cathedral area) suddenly began to play. Carol felt goose bumps rise on her arms, partially due to the beauty of the music and partially because it reminded her again of what a bizarre world she had entered. What is that organ playing? she thought to herself. It sounds like an overture. She listened for a few seconds. Why . . . that's an introduction. To "Silent Night"! It's very creative.

The organ sound was joined by several others, each emanating from somewhere in the ceiling. All the instruments together played a complex version of the "Silent Night" that Carol had so painstakingly pounded out on the writing table a few moments before. The beautiful music swelled throughout the cathedral. Carol looked up and then closed her eyes. She spun her body around and around in a little dance. When she opened her eyes again, each of them confronted what appeared to be a tiny optical instrument no more than an inch away. Carol froze in terror.

The thing had noiselessly come up behind her while she was playing music at the writing table and had waited patiently, while deploying its appendages, until she was ready to turn around. It was about her height now and the closest part of the translucent main body was only an arm's length away. As Carol stood there motionless, barely daring to breathe, five or six of the thing's attachments came forward to touch her. A small digging instrument scraped some skin off her bare shoulder. The sword cut off some of her hair. A tiny cord attached to one of the long rods wrapped around her wrist. A set of bristles the size of the head of a toothbrush traveled across her chest, tickling her nipples through her bathing suit and crossing over the camera that was draped around her neck. She was having so many feelings simultaneously that she had lost track of all the stimuli. Carol closed her eyes and tried to concentrate on something else. She felt a needle prick her forehead.

It was over very fast, less than a minute altogether. The thing retracted its appendages, backed up a couple of feet and stood there, observing her from a distance. Carol waited. After another twenty seconds, the attachments were stowed, as they had been when the thing had gone after Troy, and it left the room.

Carol listened for sounds. It was totally quiet again. She backed up from the writing table and tried to organize her thoughts. After about a minute, the purple and gold wall panels began to move to the side on their own accord. They folded upon themselves and formed small stacks. Then the corridors around the music room collapsed and automatically organized their partitions into neat piles. Carol found herself standing in one huge room under the cathedral ceilings. In the distance her weird antagonist with the flailing appendages passed through a side door about twenty-five yards away and disappeared quickly from view.

She looked around. There was no sign of Troy. The walls were creamy white and nondescript, somewhat boring after the colored panels in the earlier rooms. There were two doors, opposite each other in the middle of the room. Except for the musical instruments, which now seemed completely out of place clustered together at one end of such a vast room, the only other object she could see was a small piece of carpet against thc wall to the left. In front of her against the far wall, about fifty yards away, there was what appeared to be

a large window on the ocean. Even from a distance she could see and identify some of the fish swimming by.

At first Carol hurried toward the window. When she was about halfway there and even with the doors, she stopped a few seconds and took a few photographs of the rather bland room. Curiously, the small carpet was not where she remembered it. It had somehow been moved while she was walking. She approached the carpet very slowly. Her weird experiences since she and Troy had been sucked out of the ocean had made Carol understandably wary. As she drew closer, she saw that the flat object lying on the floor was definite]y not a carpet. From above she could see an intricate internal design, like a complex network of sophisticated electronic chips. There were strange whorls and geometric patterns on its surface; they had no specific meaning to Carol but they reminded her of the fractal designs Dr. Dale had shown her one night in his apartment. The symmetries of the object were readily apparent. In fact, each of the four quadrants of the carpet was identical.

It was about six feet long, three feet wide, and two inches thick. The dominant color was slate gray, although there were some significant color variations. Some of the larger individual components must have been color-coded according to some master plan. Carol could identify groupings of similar elements in red, yellow, blue, and white within the design. The overall harmony of the colors was striking, suggesting that some effort had been made by the designers to include aesthetic considerations.

Carol bent down on her knees beside the carpet and studied it more intently. Its surface was densely packed. The closer she looked, the more detail she found. Extraordinary, she thought. But what in the world is it? And how did it move? Or could I possibly have imagined it? She put her hand on the exposed top surface. She felt a soft tingle, like a gentle electric shock. She slid one hand under the edge and lifted slightly. It was heavy. She removed her hand.

Her desire to escape from this strange world now overruled her curiosity. Carol took a photograph of the carpet from the top and started walking away in the direction of the window. After several strides, she turned quickly to her left to look at the carpet one more time. It had moved again and was still even with her in the room. Carol continued walking toward the window, now watching the carpet out of the corner of her eye. When she had walked another ten feet, her peripheral vision saw it arch up quickly along a line through its center, pulling the rear of its body in a forward direction. Half a second later the front end of the carpet scooted forward and the center fell flat against the floor again. This maneuver was repeated six or eight times in rapid succession as the carpet zipped up to a position even with Carol in the room.

Despite her situation, Carol laughed. She was still full of adrenaline and uptight, but there was definitely something humorous about a multicolored carpet that could crawl like an inchworm. “Ha,” Carol said out loud, “I caught you. Now you owe me an explanation.”

Carol certainly did not expect a reply to her comment. Nevertheless, after just a short delay, the behavior of the carpet was altered. First it began to generate small wave pulses along its surface, with four or five crests from front to back. After smartly reversing the direction of motion of the waves several times, the carpet’s next trick was to keep its front end fixed on the floor, as if there were suction cups holding it down, and raise its back side entirely off the floor. In that mode it was about six feet tall. It seemed to be looking at Carol.

She was flabbergasted. “Well, I asked for it,” she said out loud, still amused by the antics of the carpet. Now it seemed to be motioning for her to go toward the window. I have lost my mind, she thought to herself. Completely. Troy was right. Maybe we’re dead. The carpet arched over on the floor and began to scamper toward the window, tumbling in somersaults like a slinky toy.

Carol followed. This is nuts, she thought as she watched the carpet move somehow through the window and into the ocean. And Alice thought she was in Wonderland.

The carpet was playing in the water, dodging fish as they swam by in schools and teasing a sea urchin stuck fast against the reef. At length it came back into the room and stood upright. A little water dripped on the floor when the carpet set in motion a series of fast simultaneous waves, both latitudinal and longitudinal, that effectively shook the residual liquid from its surface. It then faced Carol and clearly beckoned for her to go through the window into the ocean

"Look here, flat guy," she said, chuckling to herself as she tried to figure out what to say. Now I know I'm insane, she thought in a flash. I'm standing here talking to a carpet. Next thing I know it will talk back. "Now I'm not stupid," she continued. "I recognize that you're trying to get me to go into the ocean. But there are a few things that you don't — "

The carpet interrupted the conversation by going quickly through the window into the ocean again. It performed a couple of flips and came back into the room with Carol. Once more it shook itself and then stood rigidly, upright as before as if to say, "See, it's easy."

"As I was saying," Carol began again, "I have perhaps gone crazy, but I'm willing to trust that I can indeed go through that window in some magical way. My problem is that these is water out there. I can't breathe in water. Without my diving gear, which I left somewhere in this labyrinth, I will die "

The carpet didn't move. Carol repeated her statement, using elaborate hand gestures to make her key points. Then she fell silent. After a short wait the carpet began to move about actively. It then approached her carefully and amazingly stretched itself out in all directions so that it was almost double its original size. Carol wasn't significantly fazed. At this point she was almost incapable of being astonished again. Even by an elastic carpet that pulled its two top sides together, over her head, to form a cone.

Carol backed away a couple of steps from the now giant carpet. "Oh ho," she said, "I think I understand. You are going to form an air pocket for me so that I can breathe." She stood still for a moment, thinking and shaking her head. "Why not," she said at last, "it's no weirder than anything else that's happened."

With the carpet hovering over and around her head, Carol closed her eyes and walked directly toward the window. She took a deep breath when she felt a soft plastic touch on different parts of her body. Suddenly the water was all around her except for the small air pocket from the neck up. It was hard for Carol to keep her diving discipline, but she managed to equalize the pressure every six to eight feet during her ascent. She took one final breath and zoomed up to the surface. The carpet peeled off in the last foot before she broke water.

The Florida Queen was about fifty yards away. "Nick," she shouted with all her might, "Nick, over here." She swam furiously toward the boat. A wave broke over her head. The boat was again visible, she could see a figure in profile. He was looking over the side of the boat. "Nick," Carol cried again when she had gathered her strength. This time he heard her and turned around. She waved her arms.

5

NICK had followed Carol and Troy on the monitor right after their initial descent, when they were still directly under the boat searching for the fissure. But he had quickly tired of watching them swim around in circles and had returned to his deck chair to read his novel. Afterward he had walked over to

the screen several more times to look for them and had seen nothing; Carol and Troy had already left to investigate the area under the overhang.

Nick had checked the monitor again after he had finished Madame Bovary. He had been a little surprised to discover that the fissure was again clearly visible underneath the Florida Queen. He next assumed that he must have been correct, that it had just been a case of bad lighting, since with the sun directly overhead, the hole in the reef looked much smaller to him than it had two days before. He had then busied himself about the boat until his wrist alarm went off, indicating that Carol and Troy had about five more minutes of air remaining.

Nick walked over and looked at the images being taken by the ocean telescope and placed in realtime on the screen. There was no sign of Carol and Troy under the boat. Nick started becoming restive. I hope they're paying attention, he thought. He realized that they had been gone from view for a long time and that he had never seen them actually explore the fissure, their primary goal. A creeping disquiet began to spread through him as the clock continued to run out.

There's only one explanation, he thought, fighting against the negative ideas that were filtering into his mind. They have been gone a long time, so they must have found something interesting at the overhang. Or somewhere else. For just a moment Nick imagined that Carol and Troy had found a lode of treasure, full of objects that looked like the strange trident they had retrieved on Thursday.

The second hand seemed to be racing on his watch. It was now one minute until they should run out of air. Nick nervously checked the monitor again. Nothing. He felt his heart speed up. They must be in the red, he thought. Even if they have carefully conserved the air, they must be in the red. Nick worried for a second about a gauge failure, but he quickly remembered checking both of them himself when he arrived at the boat that morning. Besides, it's terribly unlikely they would both fail . . . so there must be trouble.

Another minute passed and Nick realized that he had not formulated a plan as to what he would do if they didn't show up. His mind raced swiftly through his options. There were two distinctly different action patterns he could follow. He could put on his diving gear and go look for them along the trench between the fissure and the overhang. Or he could assume that, in their excitement, Carol and Troy had simply neglected to check their air gauges regularly and as a result had been forced to surface wherever they were when they ran out of air.

If I go down after them, he thought, I probably won't reach them in time. Nick had a moment of self-recrimination because he had not properly prepared for this contingency. It would take him several valuable minutes to put on and check out his own diving apparatus. That settles it. I must assume they're around here somewhere. Floating on the surface. He looked briefly at the screen one more time and then walked over to the side of the boat. He scanned the ocean. It was a little choppy now. He didn't see any sign of them.

Nick turned on the engine and pulled in the anchor. He made a quick mental assessment of the general direction to the overhang and started steering with the engine at very low throttle. Unfortunately, he could not see the telescope monitor from the steering wheel, and the canopy blocked his vision behind him. Nick was in perpetual motion, back and forth from the wheel to the screen to the sides of the boat. As his fear and frustration began to build, so did his anger. It was now five minutes after the nominal time that their air supply would have been depleted.

Damnit, Nick thought, still not allowing his brain to nurture images of disaster, How could they be so careless? I knew I shouldn't have let them go as a pair. He continued to castigate himself and then turned on Carol. I let that woman push me

around. I will sure as hell straighten her out when I find them. Nick turned the boat sharply to the left.

He thought he heard a voice. Nick ran to the side of the boat. He had no sense of what direction the shout had come from. After two or three more seconds he heard it again. He turned and saw a figure wave. Nick waved back and went over to the steering wheel to change the direction of the boat. He pulled out a strong rope from the equipment drawer and tied it around one of the stanchions next to the ladder. He threw the line to Carol as the boat pulled up alongside her and then he cut the motor back to idle.

She had no trouble catching the line. As he was reeling her in, Nick's eyes searched the surrounding water for Troy. He could not see him. Carol had now reached the ladder. "You would not believe . . ." she started, trying to catch her breath as she put her first foot on the ladder.

"Where's Troy?" interrupted Nick. gesturing out at the ocean.

Carol took another step up the ladder. It was clear that she was exhausted. Nick took her hand and she came into the boat. She stood up on her wobbly legs.

"Where's Troy?" Nick asked again forcefully. He looked at Carol. "And what happened to all your gear?"

Carol took a deep breath. "I . . . don't know . . . where Troy is," she stammered. "We were sucked down — "

"You don't know!" shouted Nick, now frantically looking around on the ocean surface. "You go on a dive, come up without your gear, and don't know where your partner is. What kind — "

A small wave hit the boat. Carol had raised her hand to protest Nick's diatribe, but the motion of the boat knocked her feet out from under her. She fell hard on her knees and winced at the pain. Nick was hovering over her, still shouting. "Well, Miss Perfect, you better come up with some fucking answers fast. If we don't find Troy soon, he'll be dead. And if he's dead, it will be your goddamn fault."

Carol instinctively cowered at the anger of the large man. Her knees hurt, she was exhausted, and this man was yelling in her face. Suddenly her emotions gave way. "Shut up," she shouted. "Shut up, you asshole. And get away from me." She was flailing with her arms, hitting Nick on the legs and in the stomach. "You don't know anything," she said after taking a quick breath. "You don't know shit."

Carol put her head in her hands and began to cry. In that instant, a long-buried memory burst upon her mind Her five-year-old brother was sobbing hysterically and attacking her, pummeling her with his fists. She had her hands up to protect herself. "It's your fault, Carol," he was screaming, "he left because of you." She remembered the hot tears in her eyes. "It's not true, Richie, it's not true. It wasn't my fault."

On the boat Carol glanced up through her tears at Nick. He had backed away and was looking sheepish. She wiped her eyes and took a deep breath. "It was not my fault," Carol said deliberately and emphatically. Nick stuck out his hand to help her up and she smacked it away. He mumbled "I'm sorry" as she rose to her feet. "Now if you'll just shut up and listen," she continued, "I'll tell you what happened. The reef under the boat wasn't a reef at all . . . Oh, my God . . . It's here."

Nick saw a look of consternation break on Carol's face. She pointed over behind him, on the other side of the boat. He turned around to look. At first he didn't notice anything. Then he saw a strange flat object that looked like a piece of carpet inching along the boat toward the telescope monitor. He screwed up his face and turned back to Carol with a puzzled expression.

While Carol had been talking, the carpet had somehow crawled up the side and then flopped into the boat. By the time she started to explain, it was already standing in front of the television monitor, looking at the images the

telescope was taking of the ocean floor beneath the boat. There was no time for lengthy explanations. “What the fuck?” Nick said, and walked over to apprehend the peculiar visitor. When his hand was about an inch away from touching the carpet, he felt a strong electrical discharge in the end of his fingers. “Ow!” he said, jumping back. He shook his hand and watched with amazement. The carpet continued to stand in front of the screen.

Nick looked at Carol as if he expected some assistance. But she was finding the whole scene amusing. “That thing is just one of the reasons the dive was strange,” she said, making no effort to provide any help. “But I don’t think it will hurt you. It probably saved my life.”

Nick grabbed a small fishnet hanging on the side of the structure holding up the canopy and slowly approached the carpet. As he drew near, it seemed to turn and look at him. Nick lunged forward with the net. The carpet dodged deftly and Nick lost his balance. He fell against the monitor with his arms akimbo. Carol laughed out loud, remembering the first time they met. The carpet flipped over to the telescope data system and wrapped itself tightly around the entire set of electronic equipment.

From the floor of the boat Nick watched the carpet investigating the data system and shook his head in disbelief. “What the hell is that thing anyway?” he shouted to Carol.

She came over and graciously offered a hand to help him up. It was her way of apologizing for her earlier outburst. “I have no earthly idea,” Carol replied. “At first I thought it might be a sophisticated Navy robot. But it is much too advanced, too intelligent.” She pointed at the sky with her free left hand. “They know,” she said with a smile.

The comment reminded Carol of Troy and she became solemn. She walked over to the side of the boat and stared at the ocean. Nick was now standing up next to the monitor within an arm’s length of the carpet and the data system. It looked as if the carpet had somehow extended part of itself into the internal electronics. Nick watched for a few seconds, fascinated, as the various digital diagnostic readouts on the top of the data system went crazy. “Hey, Carol,” he said. “Come here and look at this. That damn thing is plastic or something.”

She did not turn around at first. “Nick,” Carol asked softly, finally facing him, “what are we going to do about Troy?”

“As soon as we get this damn invader out of here,” Nick replied from underneath the canopy, where he was now looking through his kitchen implements, “we’ll do a systematic search of the area. I may even dive and see if I can find him.”

Nick had picked up a large cooking fork with a plastic handle and was about to attempt to pry the carpet off the data system. “I wouldn’t do that if I were you,” admonished Carol. “He’ll leave when he’s ready.”

But it was too late. Nick stuck the fork into and through the carpet and up against the uppermost rack of electronic parts. There was a popping sound and a tiny blue arc zapped down the fork, driving Nick backward with a powerful kick. Alarms went off, the digital readout from the data system went blank, and the ocean telescope monitor began to smoke. The carpet dropped down on the floor and began making the little waves that it had showed to Carol in the large room with the window on the ocean. A moment later, two alarms from the navigation system sounded, indicating not only that the boat’s current location had been lost, but also that the nonvolatile memory, where all the parameters that permitted satellite communication were stored, had been erased.

In the middle of the noise and smoke, Nick stood with a puzzled expression on his face. He was rubbing his right arm from his wrist to his shoulder. “I’m numb,” he said in astonishment. “I can’t feel anything in my arm.”

The carpet continued with its wave patterns on the floor of the boat while Carol picked up a pail, leaned overboard for some water, and doused the monitor. Nick had not moved. He was still standing there, looking helpless and pinching

his arm. Carol threw the rest of the water on Nick. “Shit,” he sputtered, backing up involuntarily, “why did you do that?”

“Because we have to find Troy,” she said, walking over to the boat’s controls. “And we can’t wait all day. Ignore the damn carpet . . . and your arm. A man’s life is at stake.”

She increased the speed of the boat. As she did, the carpet stood up again, twisted around, and hustled to the side. Nick tried to stop it but it was out of the boat and into the water in a flash. As Carol steered the boat through circles of larger and larger radius, Nick stood on the side of the Florida Queen and searched for Troy.

An hour later they both agreed there was no reason for them to continue the search. Carol and Nick had been over the entire region of the ocean in the boat several times (with some care and difficulty, because they no longer had a working navigation system) and had found no trace of Troy. After he had convinced himself that his arm was all right. Nick had even donned his diving equipment, as a last resort, and had retraced the path from the fissure to the overhang and back. Still no sign of Troy. Nick had been just slightly tempted to investigate the fissure, but Carol’s wild story seemed remotely plausible, and Nick did not like the idea of being sucked into some bizarre underground laboratory. And he knew that if he were to disappear, it would be virtually impossible for Carol to guide the boat back to Key West without an active navigation system.

Carol recounted the whole story of her dive while she and Nick were canvassing the area. He was certain she was liberally embellishing the details, but he could see no over-arching logical flaws in her tale. And he himself had, after all, confronted the carpet on the Florida Queen. So he acknowledged, in his own mind, that Carol and Troy had indeed had hair-raising experiences in an underwater building of some type and that the technology they had encountered was definitely more advanced than anything they had ever seen before

But Nick was reluctant to accept Carol’s blithe explanation that the trio had met some extraterrestrials. It didn’t seem likely to Nick that a first contact would be made under such mundane circumstances Although he readily admitted that the carpet was a marvel of capability far beyond his ken, he did not think of himself as being technologically sophisticated and therefore he could not state, categorically, that human beings could not have created it.

Infact, Nick thought to himself as he was carefully searching the horizon with his binoculars for reference landmarks before beginning the trip back to Key West, what a perfect deception. Suppose the Russians or even our own Navy wanted to mislead . . . He stopped himself in mid-thought and realized that if he were right, and their encounter had been with a human creation, then they could very well still be in danger. But why was Carol allowed to leave? And why didn’t they confiscate my boat? Nick found a small island that he recognized off in the distance and changed the orientation of the boat. He shook his head. It was all very confusing.

“You don’t agree with me that we’ve just met some ETs?” Carol came up beside Nick and slightly teased him with her question.

“I don’t know,” he answered slowly. “It seems like quite a leap to make. After all, if there is an extraterrestrial infestation in the waters of the Gulf of Mexico, it should have been found before now. Submarines and other boats with active sonar must cross this region at least once or twice a year.” He smiled at her. “You’ve been reading too much science fiction.”

“On the contrary,” she responded, fixing him with her gaze, “my experience with state-of-the-art technology is almost certainly more extensive than yours. I have done a series of features on the Miami Oceanographic Institute and have seen what kind of ingenious new concepts are being developed. And nothing, absolutely nothing, comes close to the carpet or the giant amoeba thing. The

likelihood that there is some nonfantastic explanation for all this is very very small." She paused for a moment. "Besides," she continued, "maybe the laboratory hasn't been there for long. Maybe it was just recently finished or even transported here."

Nick had felt himself bridle when Carol had started her comment. There she goes again, he had thought. So sure of herself. So cocky and competitive. Almost like a man. He admitted to himself that he had also been known to make arguments from authority. And she was certainly right in one respect. She had had much more exposure to high technology than he had. Nick decided not to argue with her. This time.

There was a momentary pause in the conversation. Carol was also becoming more sensitive to the dynamic of their interaction. She had noticed in realtime that Nick's face had tightened when she had suggested that she knew more about technology than he did. Uh oh, had flashed through her mind. Come on, Carol. Be a little more tactful and considerate. She decided to change the subject.

"How long will it take us to reach the marina?" she asked. In her excitement on Thursday afternoon, she had not paid much attention to time during their return trip.

"A little less than two hours," Nick replied. He laughed. "Unless I get lost. I haven't used manual guidance in these waters for over five years."

"And what are you going to say when we get there?"

Nick looked at her. "To whom . . . about what?" he asked.

"You know. About our dive. About Troy."

They stared at each other. Nick finally broke the silence. "My vote would be to say nothing about it . . . until . . . until we know for certain," he said quietly. "Then if Troy shows up, there's no problem."

"And if he doesn't ever show up . . . " Carol's voice trailed off, "then we, Mr. Williams, are both in very deep shit." The gravity of their situation was becoming clear to both of them.

"But who do you think will ever believe such an incredible tale?" Nick said after a moment. "Even with your pictures, there's no really hard evidence to corroborate our story. These days people can create any kind of photo they want on a computer. Remember that murder case in Miami last year, where an alibi photograph was produced and admitted as official evidence? And then later that data processor showed up and blew the whistle?" He paused. Carol was listening intently. "And whoever built that place may be dismantling it at this very moment," he continued. "Otherwise. why did they let us get away? No. I say we wait awhile. Twenty-four hours or so anyway. And think carefully about what we're going to do."

Carol nodded her head affirmatively. "I think I agree with you, although not exactly for the same reasons." She was aware there was still a journalistic voice inside her that wanted to guard the information for her sensational scoop. She hoped her ambition wasn't somehow standing in the way of making the right decision for Troy. "But Nick," Carol said reflectively, "you don't think we're endangering Troy in any way by not contacting the authorities?"

"No," Nick replied immediately. "I suspect that if they were going to kill him, they would have done so already. Or will soon."

This part of the conversation was too casual for Carol. She walked over to the edge of the boat and stared out at the sea again. She thought of Troy and their wild adventure after they were sucked into the fissure. He had helped her hang together. No question about it. His humor and wit had kept her from falling apart. And he may have well saved her life by deflecting the attention of that thing.

He was a warm, sensitive man underneath that funny exterior, she thought. Very aware. He also seemed to be covering lots of pain. From somewhere. For a moment Carol convinced herself that Troy was all right. After all, they had helped her to escape. Then she wondered why she had never run into him again

down there. A seed of doubt was planted in her mind. She squirmed. Damnit. We don't really know one way or the other. It's uncertainty again. I hate uncertainty. It's unfair.

A profound sadness, a deep and disturbing feeling from the past, stirred in Carol. She felt helpless, without any control of the situation. Tears filled her eyes. Nick had come up beside her without saying anything. He saw the tears in her eyes but didn't comment. He just put his hand over hers for a moment and then removed it.

"Troy was becoming a good friend," Carol said, starting to hide what she was really feeling. All of a sudden her need to share her true emotions overcame her normal protection mechanisms. She looked down at the water. "But that's not really why I'm upset just now. I'm crying because of the uncertainty. I can't stand not knowing." Carol paused and wiped her eyes.

Nick was quiet. He did not understand exactly what she was saying, but he sensed that something special was about to happen between them. The gentle waves lapped against the side of the boat. "It reminds me of my childhood, right after my father left," she continued softly. "I kept believing that he would be coming back. All three of us, Richie, my mom, and I, would tell each other that it was just a temporary separation, that someday he would walk through the door and say 'I'm home.' At night I would lie in my bed and listen for the sound of his car in the driveway."

The tears were flowing now, big drops cascading down her cheeks and falling into the vast ocean. "When he would come to pick us up for dinner, or on a Saturday, I would help Mom fix herself up, choose her clothes for her, brush her hair." Carol choked up for a moment. "After I hugged him at the door, I would always take him to Mother and say, 'Isn't she beautiful?'

"For six months this went on. I never knew what I was going to feel from day to day. The uncertainty destroyed me, made me sick. I begged my father to give my mom one more chance. Richie even suggested that he could buy the house next door if he and Mother couldn't get along. So we could at least all be close together." Carol smiled grimly and took a huge breath.

"Then my father took my mother to San Francisco for the weekend. I was so excited. For thirty-six hours my heart soared, my future was assured. I was the happiest ten-year-old girl in the San Fernando Valley. But when they came home un Sunday night my mother was very drunk. Her eyes were swollen, her mascara was running, she was a mess. She marched right past Richie and me and went to her room. My dad, Richie, and I stood in the living room, all hugging, and wept together. In that instant I knew it was all over."

Carol was calming down now but the tears were still there. She looked at Nick, her eyes entreating. "It would have been so much easier if I could have cried one time and been done with it. But no. There was uncertainty, so there was still hope. So every day, every goddamn day, my little heart was broken again." Carol wiped her eyes one more time. Then she looked out at the ocean and shouted with all her might, "I want to know now, or at least soon, what happened to Troy! Don't make me wait forever. I can't take it."

She turned to Nick. He opened his arms. Without a word she put the side of her face against his chest. He closed his arms around her.

6

NICK reached above the door to Troy's duplex and found the key on the ledge. He knocked on the door again and opened it cautiously. "Hello," he called out, "is anybody there?"

Carol followed him into the living room. "I didn't know you two were such close friends," she said, after she glanced with amusement at Troy's motley

collection of furniture. “I don’t think I’ve ever told anyone where I keep my key.”

What Nick was looking for was not in the living room. He walked down the hallway, past the large bedroom with its storehouse of equipment, and into the smaller bedroom where Troy slept. “Actually,” Nick yelled at Carol, who had stopped behind him in the hall opposite the first bedroom and was gawking at the jumble of electronics filling every conceivable cranny, “it was only yesterday that I came over here for the first time. So I don’t really know where . . . oh, good, I think I’ve found something.” He picked up a sheet of computer printout that was underneath a paperweight on the end table beside Troy’s bed. It was dated January 15, 1994, and contained about twenty names, addresses, and phone numbers.

Nick met Carol in the hallway. He read quickly through the page and showed it to her. “There’s not much here. Phone numbers and addresses for electronics and software supply houses. A bunch of numbers for Angie Leatherwood, probably while she was still on tour.” He pointed at one entry. “This must be his mother, Kathryn Jefferson, in Coral Gables, Florida. But there’s no phone number listed with the address.”

Carol took the sheet from Nick and checked it herself. “I never heard him mention anyone but Angie, his mother, and his brother Jamie. No other friends or family. And I somehow have the impression that he hasn’t seen much of his mother recently. Did you ever hear him say anything about any other family?”

“No,” Nick replied. They had wandered together into the game room and Nick was idly turning knobs and switches as he walked past the arrays of equipment. He stopped and thought for a moment. “So that means Angie is the one. We’ll tell her right away and then wait — ”

Carol and Nick both froze as they distinctly heard the front door open and close. After about a second, Nick called out in a loud but uncertain voice, “Hello, whoever it is, we’re back here in the bedroom.” There was no answer. They could hear soft footsteps in the hallway. Nick instinctively moved over to protect Carol. A moment later Troy came around the corner and into the room.

“Well, well,” he said, grinning broadly, “as I live and breathe. I have found a pair of burglars in my home.”

Carol ran up to Troy and threw her arms around his neck. “Troy,” she said, her comments coming in quick staccato bursts, “is it ever good to see you. Where have you been? You scared the shit out of us. We thought you were dead.”

Troy returned Carol’s hug and winked at Nick. “My, my. Such a reception. I should have vanished before.” He extended a hand to shake the one that Nick was offering him. For a moment his face became serious. “On second thought, one experience like that is definitely enough.”

Carol backed away and Troy saw the computer sheet in her hand. “We were going to try to notify your family . . .” she started. Troy reached out to take the page and Carol noticed a bracelet on Troy’s right wrist that she had never seen before. It was wide, almost an inch and a half, and looked as if its twenty or so links had been made from flattened gold nuggets. “Where did you get this?” Carol asked, holding his wrist up so that she could see the bracelet more clearly.

Nick was unable to restrain himself any longer. Before Troy could answer Carol’s question, he jumped into the conversation. “According to Carol,” he said, “you were last seen disappearing down a corridor in an underwater laboratory. With a six-foot amoeba in hot pursuit. How the hell did you escape? We searched all over the area . . .”

Troy held up his hands. He was enjoying being the center of attention. “Friends, friends. Wait a minute, will you? I will tell you the story as soon as I take care of the necessities of life.” He turned and walked into the bathroom. Nick and Carol heard a familiar sound. “Get some beer out of the

refrigerator and go into the living room," Troy shouted from behind the closed door. "We might as well enjoy this part of it."

Two minutes later Nick and Carol were sitting together on the large couch in the living room. Troy plopped into the chair opposite them just as Nick took a huge swig from his beer. "Once upon a time," Troy began with a mischievous grin, "there was a young black named Troy Jefferson, who, while diving with his friends, vanished for almost two hours in a strange building underneath the ocean. When he emerged from his underwater adventure, he was rescued by divers from the United States Navy, who just happened to be in the area at the time. Soon thereafter young Troy was flown in a military helicopter back to Key West. There he was interrogated at length about why he was swimming in the Gulf of Mexico, all by himself, ten miles from the nearest island. An hour later he was released without anyone believing any part of his story." Troy looked back and forth from Nick to Carol. "Of course," he added, now more serious, "I didn't tell them anything that really happened. There's no way they would have believed the truth."

Carol was leaning forward on the couch. "So the Navy picked you up. Just after we left." She turned to Nick. "They must have been following us for some reason." The missile must have been there after all, she thought to herself. But where did it go? Did the Navy find it? And how are they involved with this crazy laboratory? Nothing makes sense . . .

"We spent over an hour looking for you." Nick was saying. He was feeling remorseful because they had abandoned the search for Troy so quickly. "It didn't occur to me that you might still be down in that place, whatever it was, and of course we couldn't hang around forever. All of our electronics were zapped by this funny carpet thing that came out of the sea. So we lost all nav — " He stopped in mid-sentence and looked at Troy. "I'm sorry, friend."

"Don't worry about it," Troy replied with a shrug, "I would have done the same thing. At least I now know that you have met one of the bizarre characters in my story. You didn't, by any chance, also meet one of the wardens did you? Great big globs of clear jelly, amoebalike, with little boxes in the middle and removable rods hanging out all over the top?"

Nick shook his head. "Warden?" Carol asked quickly, her brow knitted. "Why do you call that thing a warden?"

Warden, sentinel, whatever," Troy answered. "They told me the warden things protect the principal cargo of the ship." Troy stared into the blank gazes of his friends. "Which leads me back to the first question," he continued. "They gave me this bracelet. It is some kind of two-way communications device. I couldn't begin to explain how it works, but I know that they are listening and watching as well as transmitting messages to me. Only a few of which I understand."

Carol was starting to feel overwhelmed again. In her mind this already complex situation had added a new dimension. Hundreds of questions were crowding into her brain and she could not decide which one to ask first.

Meanwhile Nick stood up. "Hold it a minute," he said, looking dubious and just a little confused. "Did I hear you right? Did you say you were given a communications bracelet by some extraterrestrials and then released into the ocean? And then the Navy picked you up and brought you back to Key West? Christ, Jefferson, you do have an imagination. Save your creativity for that computer game. Please just tell us the truth."

"I am," replied Troy. "Really — "

"What did they look like?" Carol interrupted, her journalistic training taking over. She had pulled a small tape recorder, the size of a fountain pen, out of her purse. Troy reached over and switched it off." For now, angel, " he said, "this is strictly between us . . . I don't think I saw any of them anyway. Just the wardens and the carpets. And my guess is that they're just

robots, machines of some type. Intelligent, yes, but controlled by something else — ”

“Jesus,” Nick interrupted, “you’re serious.” He was becoming exasperated. “This is turning into the most amazing shaggy dog story that I have ever heard. Wardens, carpets, robots. I am lost. Who are they? What are they doing in the ocean? And why have they given you a bracelet?” He picked up one of the little pillows on the couch and threw it across the room.

Carol laughed nervously. “Nick’s not the only one feeling frustrated, Troy. I was with you down there and I must admit that I’m having a hard time tracking your story. Maybe we should stop interrupting and let you talk. I’ve told Nick what happened in that solar system room up until you ran out and the thing or warden followed. Start from there, if you would, and tell the story in logical sequence.”

“I’m not sure there is such a thing as a logical sequence, angel,” Troy replied, echoing Carol’s laugh. “The whole episode defies logic altogether. The warden thing eventually trapped me in a blind alley and sort of anesthetized me with one of its rods. It was like I was dreaming, but the dreams were real. I remember a similar feeling, after a fistfight when I was a teenager. I had a small concussion then. I knew that I was alive, but I was very very slow to react. Reality seemed toned down, out there in the distance somewhere.

“Anyway, another warden character showed up, same kind of body but different fixtures sticking in the jelly, and carried me to what I think was an examination room. I don’t know exactly how long I was there. I was stretched out on the floor and touched by all kinds of instruments. My brain felt as if it were in superfast motion, but I don’t recall any specific thoughts. Some images I do remember. I relived my brother, Jamie, breaking through the line on a trap play and going forty-five yards for a touchdown in the Florida state championship. Then the bracelet was put on my wrist and I had the distinct impression that someone was talking to me. Very quietly, perhaps even in a foreign language, but every now and then I understood what was being said.

“What they told me,” Troy continued with an intense and distant expression on his face, “was that what we call the laboratory is really a space vehicle from another world. And that it has crash-landed, in a sense, on the Earth to allow time for some difficult repairs. They, that is, whoever built the ship, need help from us, from me and you, to obtain some of the specific items necessary for the repairs. Then they can continue on their journey.”

Nick was now sitting on the floor just opposite Troy. Both Carol and he were hanging on every word. They sat in silence for almost thirty seconds after Troy had finished. “If this story is true,” Nick finally spoke, “then we are — ”

There was a loud knock at the door. All three of them jumped. Several seconds later the knock repeated. Troy went to the door and partially opened it.

“There you are, you little shit,” Carol and Nick heard a gruff, angry voice say. Captain Homer Ashford pushed through the door. He didn’t see Nick and Carol at first. “We had a deal and you’ve welshed on it. You have been back two hours already . . .”

Out of the corner of his eye, Captain Homer saw that there were other people in the room. He turned around to talk to Greta, who had not yet entered the house. “Guess what?” he said. “Nick Williams and Miss Dawson are also here. No wonder we couldn’t find her at the hotel.”

Greta followed Homer into the living room. Her clear, expressionless eyes spent no more than one second staring at each of the trio. Carol thought she saw just a trace of disdain in Greta’s look, but she wasn’t certain. Homer turned to Carol, the tone in his voice markedly more civil. “We saw you two return from your excursion around two o’clock,” he said with a fake smile. “But

somehow we missed Troy." He winked at Carol and turned to Nick. "Find any more exciting trinkets today, Williams?"

Nick had never made any attempt to hide the fact that he did not like Captain Homer. "Why of course, Captain," he answered, sneering the epithet, "would you believe we found a veritable mountain of gold and silver bars? Looked like that Santa Rosa stack we had on the boat one afternoon, must be about eight years ago. Remember? That was before Jake and I let you and Greta unload it."

Homer's voice had a nasty edge to it. "I should have sued you for slander, Williams. That would have shut your loud mouth once and for all. You had your day in court. Now knock off the crap, or one day you'll have more trouble than you can handle."

While Nick and Homer were trading insults and threats, Greta was strutting around the living room as if she were in her own house. She seemed to be oblivious to the conversation and even to the presence of the other people in the room. She was wearing a tight white muscle shirt and a pair of navy blue shorts. When Greta walked, she carried her arms high, her back straight, and her breasts erect. Carol was intrigued by her behavior. She watched Greta stop and sort through Troy's compact discs. Greta pulled out the disc with the cover picture of Angie Leatherwood and licked her lips. This pair belongs in a kinky novel, Carol thought, as she overheard Troy tell Captain Homer that he was busy this afternoon but would get back to him later. What's their story? wondered Carol. And where does fat Ellen fit in? Carol remembered that she was scheduled to interview the three of them later in the evening. But I'm not sure that I really want to find out.

"We were calling to tell you to bring your swimming suit tonight," Captain Homer was addressing Carol. She had missed the first part of his statement while she was watching Greta parade around the room.

"Pardon me," she said politely. "Could you repeat what you just said? I'm afraid I had drifted away for a few seconds."

"I said that you should come early, about eight o'clock." Homer replied. "And bring your suit. We have a most interesting and unusual pool."

During this exchange, Greta walked up behind Nick and quickly reached both arms around him. With everyone else in the room watching, she lightly twisted his nipples through his polo shirt and laughed when he jumped. "You always did like that, ya, Nikki," she said, releasing him after an instant. Carol saw anger flash in Homer's eyes. Nick started to say something but Greta had already walked out the front door before he could register a protest.

"Be sure to call me when you're through here, Homer said to Troy after an embarrassing silence. "We need to straighten out a few things." The older man turned around, awkwardly, and without additional comment followed Greta toward his Mercedes parked in front of Troy's house.

"Now where were we?" said Troy abstractedly, as he closed the door behind Homer and Greta.

"You," said Nick with emphasis, "were telling us an amazing story and had almost reached the punch line, where you were going to tell us what we could do to help some aliens who landed here on Earth to repair their space vehicle. But first I, for one, would like some explanations. I don't know if I believe any of this wild fairy tale you're telling us, but I will admit that it is extremely creative. What concerns me at this minute, however, is not the issue of creatures from another world. It's those two real-life sleazebag human beings who just left. What did they want? And are they somehow involved in our current adventure?"

"Just a minute, Nick," Carol intervened. "Before we become sidetracked, I would like to know what kind of help these ETs of Troy's want from us. A telephone? A new spaceship? Let's find this out now and talk about Homer and your girlfriend Greta later." Her reference to Greta was light and playful.

Nick accepted it with good humor and feigned a wound. Then he nodded his assent to Carol's suggestion. Troy pulled a sheet of paper from his pocket and took a deep breath.

"Now you guys must understand that I'm not yet absolutely certain that I am properly receiving all their messages. But this particular transmission, where they list the things they need from us, is repeated every half hour. My interpretation of it hasn't changed for the last ninety minutes, so I'm fairly certain that I have it right. It's a long list and of course I don't pretend to comprehend why they want all this stuff. But I am certain you will both find it very interesting."

Troy started reading from his handwritten list. "They want an English dictionary and grammar, plus the same thing for four other major languages; an encyclopedia of plant and animal life; a compact world history; a statistical tract defining the current political and economic status of the world; a comparative study of the world's major existing religions; complete issues covering the last two years of at least three significant daily newspapers; summary journals of science and technology, including surveys of weapon systems both deployed and under development; an encyclopedia of the arts, preferably including video and sound where appropriate; forty-seven pounds of lead; and fifty-eight pounds of gold."

Nick whistled when Troy was finished. At Carol's request, Troy handed the sheet to her and Nick read it another time over her shoulder, absorbing every item. Neither of them said anything. "Believe it or not," Troy added as an afterthought about a minute later, "the first eight items are not too difficult to obtain. I stopped by the Key West Public Library on the way home from the marina and, for a fee, they are preparing for me a set of compact discs that contain virtually all of the requested information. The difficult items are at the end of the list. That's where your help is needed."

Troy stopped for a second to see if Nick and Carol were following him. "Just to make certain I understand." Nick was now walking slowly around the room with the list in his hand, "what you want, or they want if you will, is for us to return to their laboratory or vehicle or whatever it is with all this information plus the lead and gold?" Troy nodded. "But fifty-eight pounds of gold? That's about a million dollars' worth. Where would we get it? And what would they do with it anyway?"

Troy acknowledged that he didn't know the answers to those questions. "But I have the feeling," he added, "again based upon what I think they are telling me, that partially satisfying their needs will make their task that much easier. So I guess we do what we can and hope that it's enough."

Nick shook his head back and forth. "You know, Carol," he said as he handed the list back to her, "never in my wildest flights of imagination could I have concocted such an intricate and crazy scheme. This entire thing is so unbelievable and fantastic that it just begs to be accepted. It's pure genius."

Troy smiled. "So you will help after all?" he asked.

"I didn't say that," answered Nick. "I still have lots of questions. And of course I can't speak for Miss Dawson. But somehow, even if it's all make believe, the idea of playing the good Samaritan for an extraterrestrial ship is very appealing."

During the next half hour both Carol and Nick questioned Troy extensively. Troy dismissed Homer and Greta in a hurry, simply stating that he had agreed on Thursday night to keep them informed about what was happening onboard the Florida Queen in exchange for a short-term loan. He also indicated that he never intended to really give them any information, but that was all right because they were crooks anyway. Nick was not completely satisfied with Troy's explanation. He felt that he was not being told the whole truth.

In fact, the more questions he asked, the more doubt there was in Nick's mind about the entire story Troy was telling. But what are the other options? Nick thought to himself. I have seen that carpet with my own eyes. If it is not an ET, or at least made by one, then it must be a very advanced robot designed by us or the Russians. As he continued to question Troy, Nick's facile mind began to construct an alternative scenario, admittedly wild and improbable, but one that nevertheless explained all the events of the previous three days in a way that Nick found just as reasonable as Troy's crazy story about the alien space vehicle.

Suppose somehow Troy and that turd Homer are working with the Russians. And this entire thing is just an elaborate cover for a rendezvous where illegal information will be passed. Homer would do anything for money. But why would Troy do it? Having Troy participate in a scheme to sell U.S. secrets to a foreign country was the acknowledged weakness in Nick's alternative explanation, but he rationalized it by convincing himself that perhaps Troy needed a lot of extra money to pay for all the electronic equipment in his computer game.

He certainly couldn't have saved enough money from his paltry salary, Nick continued thinking. So suppose these computer discs of Troy's have secret military data instead of all that crazy information he just listed. Then the gold could this payoff . Or someone else's. Nick asked several more questions about the gold. Troy admitted he did not understand very well what they were telling him, through the bracelet, about why they needed the lead and the gold. He just mumbled something about those two elements being difficult to produce by transmutation and then added nothing else.

For her part, Carol grew more and more convinced that the story Troy was telling was true. His inability to answer all the questions did not disturb her; as a matter of fact, given the rather fantastic nature of his story, if he had had pat answers to all the questions, she would have felt less assured of its truth. Despite her critical journalistic background, she found herself intrigued and a little enchanted by the idea that some superaliens from another world needed her help.

Carol's intuition was just as important as her rational thought processes in the formation of her opinion. First of all, she trusted Troy. She watched him very carefully when he answered the questions and did not see the slightest indication that he was lying. She had no doubt that Troy believed he was telling the truth. But whether Troy was indeed telling the truth, or was instead being manipulated and directed by the very ETs that he was purporting to represent, was another issue altogether. But for what purpose? she reasoned. There's not much that the three of us can do for them. Even the information they requested, except for the weapons stuff, is relatively innocuous. She temporarily set aside the notion that her friend Troy had become some kind of pawn for the aliens.

Carol could tell that Nick was growing more suspicious. Nick thought it was very peculiar that there were three Navy divers in the water at the exactly correct location when one of the carpets ushered Troy to the surface. And Troy's report of the interrogation process after they had flown him to Key West was so confused that Nick became exasperated again.

"Christ, Jefferson," he said, "you either have a very short or a very convenient memory. You tell us that the Navy kept you in custody for almost an hour, yet you hardly remember any of their questions and have no idea why they were interrogating you. That just doesn't sound right to me."

Troy was becoming a little angry. "Shit, Nick, I told you that I was tired. I had been through a traumatic experience. Their questions didn't make sense to me. And the entire time I felt as if a little voice was trying to make itself heard inside my head."

Nick turned to Carol. "I think I'm changing my mind. I don't want to play in this game, no matter how clever it is. Homer and Greta annoy me, but I

can deal with them if it's necessary. On the other hand, the Navy scares me. There was some reason they were following us. It's just too damn unlikely to be a coincidence. Maybe Troy knows something about it and maybe he doesn't. I can't tell. But I don't like the smell of it."

He stood up to leave. Carol motioned for Nick to sit down and took a deep breath. "Look, you two," she said in a low voice. "I have a confession to make. And it seems as if this is the perfect time to make it I did not come down here to Key West to look for whales." She glanced at Nick. "And not for treasure either. I came here to check out a rumor that a new Navy missile had gone astray and crashed in the Gulf of Mexico." She paused several seconds to let her message register. "I probably should have told you earlier. But I never found the right time. I'm truly sorry."

"And you thought the missile was in the fissure," said Troy a few seconds later. "Which was why you came back yesterday."

"We were going to salvage it for you and give you a worldwide scoop," added Nick, his feeling of betrayal softened somewhat by the obvious sincerity of her apology. "You were using us all the time."

"You could call it that," Carol conceded, "but as a reporter, I don't see it that way." She noticed the tension in the room. Nick seemed especially guarded. "But now it doesn't matter anyway," she continued. "What is important is that I have given an explanation for the Navy's presence at the dive site. During the last two days I have made several inquiries at all levels about the clandestine activities that the Navy currently has underway to search for the missile. Last night that Mexican lieutenant got a good look at our best close-ups of the missile in the fissure. Undoubtedly someone put two and two together."

"Look, angel," Troy spoke after another short silence, "I don't know anything about a missile. And too much is going on for me to be hurt because you lied to me. I'm sure you had your reasons. What I need to know now is whether or not you will help me take this stuff back to the ETs or aliens or whatever you want to call them."

Before Carol could answer, Nick stood up again and started walking toward the door. "I'm very hungry," he announced, "and I want to think through this entire situation. If you don't mind, Troy, I'll have an early supper and meet you later on tonight with my answer."

Carol realized that she also was extremely hungry. It had been a long, exhausting day and she had not eaten anything significant since breakfast. She was also a little concerned about Nick's response to her confession. "Why don't I join you for a bite?" she said to Nick. He gave a noncommittal shrug, as if to say suit yourself. Carol gave Troy a hug.

"Let's all meet at my room in the Marriott around seven-thirty. I have to go there anyway to dress for my interview with the triple creeps. You guys can give me some pointers."

Her humor did not lighten the atmosphere in the room. Troy was clearly worried about something. His face was very earnest, almost stern. "Professor," he said to Nick in a soft and deliberate monotone, "I know I didn't have all the answers to your questions. I don't even have the answers to my own. But I do know one thing for certain. Nothing like this has ever happened on the Earth before. At least not in recorded history. The creatures who built that spaceship are, when compared to us, as we would appear to the ants or the bees if they could comprehend us. They have asked the three of us for help in repairing their vehicle. To say that this is a once-in-a-lifetime opportunity would be a colossal under-statement.

"It would be great if we could sit around and debate this issue for weeks or even months. But we can't. Time is running out. The Navy is certain to find them soon, maybe they have already, with possibly dire circumstances for the human beings on this planet. They have made it clear to me that their

mission must be fulfilled, that they must repair their vehicle and continue their voyage, even if they must interfere with the Earth system to achieve their goal.

"I know all this sounds incredible, maybe even absurd. But I am going to collect some lead weights from my diver friends and pick up the compact discs at the library. With or without your help, I want to be over their spaceship at dawn tomorrow."

Nick studied Troy very carefully during this speech. For an instant in the middle, it seemed as if it were not Troy speaking at all, but someone or something else speaking through him. An eerie chill raced down Nick's spine. Shit, he thought. I'm as bad as they are. I'm now caught up in this thing too. He gestured to Carol to follow him and walked out the door.

7

As I have told you twice before?" the voice sounded tired and bored, "I was out diving with my friends, Nick Williams and Carol Dawson. She had a problem with her equipment and decided to make a quick return to the boat. We had found a particularly interesting reef, with some very unusual features, and we weren't certain we would be able to locate it again. So I decided to stay and wait for her to come back. When I finally surfaced half an hour later, there was no sign of them or the boat."

The recorder clicked off. The two lieutenants stared at each other. "Shit, Ramirez, do you believe that bastard's story? Any part of it?" The other man shook his head. "Then why the hell did you let him go? That black shitass sat there for an hour, making fools out of us with ridiculous answers to our questions. and then you summarily released him."

"We can't detain someone without positive evidence of wrong doing," responded Ramirez, as if he were quoting from a military manual. "And swimming in the ocean ten miles from the nearest island, although strange, does not constitute wrong doing." Ramirez could see that his colleague was scowling. "Besides, he never slipped up. He always told exactly the same story."

"The same bullshit, you mean." Lieutenant Richard Todd leaned back in his chair. The two men were sitting around a small conference table in an old room with white plaster walls. The tape recorder was on the table in front of them next to an empty ashtray. "He didn't even believe his own story. He just sat there, that cocky grin on his black face, knowing that we couldn't charge him with anything." Todd put all four of his chair legs back on the floor and pounded the table for emphasis. "An experienced diver would never stay down by himself for five minutes, much less thirty. Too many things could go wrong. As for his friends, why the hell did they leave him?" Now Todd stood up and made gestures in the air with his hands. "I'll tell you why, Lieutenant. Because they knew he was all right, that he had been picked up by a Russian submarine. Shit, I told you we should have taken one of the new vessels. We probably could have spotted the sub with the upgraded electronic gear."

Ramirez was playing idly with the glass ashtray while Todd was giving his lecture. "You really believe that those three are involved with the Russians in this, don't you? It sure seems farfetched to me."

"Fucking A," replied Todd, "nothing else makes even a tittle sense. Every engineer we have talked to says there are no conceivable failures that are consistent both with the observed behavior of the missile and the telemetry we received at our tracking stations. So the Russians must have commanded it off course."

Todd grew excited as he explained the rest of the plot. "The Russians knew they would need some local help to find the exact location of the missile in the ocean, so they hired Williams and crew to search for the bird and then tell them where it was. They planned to pick it up with one of their subs.

Adding that Dawson woman to their team was a master stroke; her inquiries have slowed down our own search by making us more concerned about the press."

Lieutenant Ramirez laughed. 'You always sound convincing, Richard. But we still do not have even one shred of evidence. I don't believe Troy Jefferson's story any more than you do, but there could be many reasons why he lied, only one of which is any of our business. Besides, there still is a fundamental problem with your explanation. Why would the Russians go to all this trouble just to seize a Panther missile?"

"You and I and even Commander Winters may not know the true story of the Panther missile," Todd countered quickly. "It may be designed to carry some new breakthrough weapon that we haven't even heard about. It's not all that unusual for the Navy to represent a project falsely and to keep its true purpose hidden." He stopped to think. "But what's motivating the Russians is not that important to us. We have evidence of a conspiracy here. Our job is to stop it."

Ramirez did not reply right away. He continued to push the ashtray around on the table. "I guess I no longer view it that way," he said at length, gazing directly at Todd. I see no substantial evidence of any conspiracy. Unless Commander Winters himself orders additional work from my department, I am abandoning my investigation." He looked at his watch. "At least I can still spend Saturday night and Sunday with my family." He rose to leave.

"And what if I bring you proof?" Todd asked, making no effort to hide his disgust with Ramirez.

"Proof will convince Winters as well," Ramirez answered coldly. "I have taken enough risk on this project. I will not take any more action unless instructed by the proper authority."

Winters wasn't really certain he would find something appropriate. Ordinarily, he carefully avoided shopping malls, especially on a Saturday afternoon. But while he had been lying on the couch, watching one of the NCAA basketball games and sipping a beer, he had remembered how pleased he had been when Helen Turnbull, who had played Maggie, had given him a set of unusual tile coasters after the opening weekend of Cat on a Hot Tin Roof. "It's a fading tradition in the theater, I fear," the experienced actress had said when he thanked her, "but giving small presents after the opening night or nights is still my way of congratulating those people I have enjoyed working with."

The mall was crowded with Saturday shoppers and Commander Winters felt oddly conspicuous, as if everyone were looking at him. He walked around for several minutes before he even thought about what kind of gift he might get for her. Something simple of course, he thought. Nothing that could be misinterpreted. Just a nice memento or souvenir. He saw Tiffani in his mind's eye as she had appeared in his fantasy just before he had fallen asleep the night before. The image embarrassed him in the shopping crowd and he nervously called up another picture, this one wholesome and acceptable, of the little girl Tiffani during his conversation with her father. Her hair, he thought, remembering the pigtails. I'll buy her something for her hair.

He walked into a gift shop and tried to make some sense out of the jumble of bric-a-brac that lined the walls and was assembled on top of an assortment of tables in no identifiable pattern. "Can I help you?" Winters jumped when a salesgirl approached him from behind. He shook his head. Now why did you do that? he said to himself. Of course you need help. Otherwise you'll never find anything.

"Excuse me, young lady," he almost shouted at the retreating salesgirl, "I guess I could use some advice. I want to buy a present." Winters again felt as if everyone were watching him. "For my niece," he added quickly.

The salesgirl was a brunette, about twenty, very plain, but with an eager face. “Did you have anything in mind?” she asked. Her hair was long, like Tiffani’s. Winters relaxed a little.

“Sort of,” he said. “She has beautiful long hair. Like yours. What could I get her that would be really special? It’s her birthday.” Again he felt a strange anxiety that he did not understand.

“What color?” the girl asked.

The question didn’t make sense. “I don’t even know yet what I want,” he replied with a puzzled expression, “so I certainly don’t know the color.”

The salesgirl smiled. “What color is your niece’s hair?” she said very slowly, almost as if she were speaking to a mental retard.

“Oh, of course,” Winters laughed. “Reddish-brown, auburn,” he said. “And it’s very long.” You said that already, a voice whispered inside of him. You are acting like a fool.

The salesgirl motioned for him to follow her and they walked back to the rear of the store. She pointed at a small round glass case full of combs of all shapes and sizes. “These would make excellent gifts for your niece,” she said. There was an inflection in her voice when she said the word “niece” that bothered Winters. Could she know something? One of her friends? Or maybe she was at the play? He took a breath and calmed himself. Again Winters was astounded by the volatility of his emotions.

On one of the small shelves were two beautiful matching brown combs with gold filigree across the top. One of the combs was large enough to hold all that magnificent hair in a chignon against her neck. The other smaller comb was a perfect size to adorn the side or back of her hairstyle. “I’ll take those,” he said to the girl, “the ones with the gold work along the top. And please giftwrap them for me.”

The efficient salesgirl reached inside the display case and pulled out the combs. She told Winters to wait a couple of minutes while she wrapped the present. She disappeared into the back of the store and winters was left alone. I’ll leave them on her dressing table at the end of intermission, he was thinking. He conjured up a picture of Tiffani going into the dressing room, by herself, and finding the present under her nameplate against the mirror. Winters smiled as he imagined her reaction. At that moment a woman with her eight- or nine-year-old daughter brushed by him in the store. “Pardon me,” the woman said, without looking around, as she and the little girl rushed to finger some Easter baskets hanging on the wall.

The salesgirl had finished wrapping the present and was standing next to the computer cash register. When Winters reached the counter, she handed him a small card that had “Happy Birthday” imprinted on the upper left corner. Winters stared at it for a few seconds. “No,” he said finally. “No card. I’ll buy another at the stationery store.”

“Cash or charge?” the girl asked him.

Winters panicked for a moment. I don’t know if I have enough cash on me, he thought. And how would I ever explain the charge to Betty? He opened his wallet and counted his money. He smiled at the girl and said “Cash, please” when he realized that he had almost fifty dollars. The bill was only thirty-two dollars, including the tax.

Commander Winters felt a rush of Joy as he nearly skipped out of the store. His earlier nervousness had completely disappeared. He even began to whistle just before he pushed open the door and left the enclosed air-conditioned environment of the mall. I hope she likes the combs, he said to himself. Then he smiled again. I know she will.

NICK poured the last of the bottle of Chablis into Carol's glass. "I don't think I could ever be a journalist," he said. "To be successful it sounds to me as if you have to be a sneak."

Carol moved a piece of broiled catfish mixed with some cauliflower onto her fork and put the bite in her mouth. "It's not that much different from any other job. There are always questions of ethics, as well as places where your personal and professional lives come into conflict. " She finished chewing her food and swallowed before she continued. "I had thought that maybe I would tell you and Troy on Friday evening. But things just didn't work out, as you know."

"If you had," Nick pushed his plate away to indicate that he was finished with his meal, "then everything would have been different. I would have been aware of the possible danger and most likely it would have been you and I in that place together. Who knows what might have happened then."

"I've had worse conflicts before." Carol took a drink from her glass of wine. She wanted to finish with this subject. In her way. "Right after I graduated from Stanford, I worked for the San Francisco Chronicle. I was dating Lucas Tipton a little at the time that the Warrior drug scandal broke. I used the social contacts I had made through him to obtain a unique slant on the story. Lucas never forgave me. So I'm used to problems. They go with the territory."

A waiter came by and poured them some coffee. "But now that I have finished apologizing, for the third time," Carol said pointedly, "I hope we can go back to more important matters. I must tell you, Nick, that I find your Russian plot idea absolutely off the wall. The weakest element is Troy. There's simply no way he could be a spy. It's preposterous."

"More preposterous than a super-alien space vehicle in need of repairs at the bottom of the Gulf of Mexico?" Nick countered stubbornly. "Besides, I have a definite motive. Money. Did you see all the equipment he has wrapped up in that computer game?"

"Angie probably makes enough off her royalties in one week to cover all that computer stuff," Carol replied. She reached across the table and put her hand on Nick's forearm. "Now don't overreact, but you know there are some relationships where the woman carries the financial load. I can tell that she loves him. There's no doubt in my mind that she would offer to help him."

"Then why did he try to borrow money from me and then Captain Homer on Thursday night?"

"Hell, Nick, I don't know." Carol was becoming slightly frustrated. "But it's irrelevant anyway. I can't imagine any set of conditions, unless I was convinced that I was going to be killed, that would prevent my going back out there with Troy. Whatever the truth is, it is certainly a sensational story. I'm surprised you are so hesitant. I thought you were an adventurer."

Carol stared directly across the table at Nick. He thought he saw a flicker of flirtation hiding behind her unwavering gaze. You are one fascinating woman, he thought. And you're taunting me a little now. I caught your double meaning. He remembered how good he had felt when he held her on the boat in the afternoon. Underneath that aggressive veneer is another person. Beautiful and intelligent. Hard as nails one minute and a vulnerable little girl the next. Nick was certain that any hope he might have of continuing his relationship with Carol was dependant on his helping Troy. She wasn't interested in men who were not willing to take chances.

"I used to be," Nick finally replied. He twirled his empty wine glass in his hand. "I don't know what happened. I guess I got stung a couple of times and that has made me more cautious. Particularly where people are concerned. But I will admit that if I stand back from this situation and imagine myself as simply an observer, I find the whole affair absolutely fascinating."

Carol finished her wine and put the glass back on the table. Nick was quiet. She drummed her fingers on the tabletop and smiled. "Well," she said,

fixing him with her eyes and picking up her coffee cup, “have you made a decision?”

He laughed. “Okay. Okay. I’ll do it.” Now it was his turn to reach out and touch her arm. “For lots of reasons.”

“Good,” she remarked. “Now that something has been decided, why don’t you help me prepare for my interview with Captain Homer and the crew. How much was the stuff worth that you pulled up from the Santa Rosa? And who was Jake? I must act as if I’m serious about this story.” Carol put her fountain pen tape recorder on the table and turned it on.

“We officially cleared a little over two million dollars. Jake Lewis and I each received ten percent, Amanda Winchester was reimbursed for the expense advance plus twenty-five percent of the profit. Homer, Ellen and Greta kept the rest.” Nick stopped but Carol indicated for him to continue. “Jake Lewis was the only close friend I have ever had as an adult. He was an absolute peach of a person, honest, hard-working, intelligent, and loyal. And completely naive. He fell for Greta like a ton of bricks. She manipulated him completely and then used his love to her own advantage.”

Nick looked away, out the window of the small seafood restaurant, at some seagulls who were soaring over the water in the fading twilight. “The night we came back with the big haul, Jake and I agreed that one of the two of us would always be awake. Even then there was something peculiar in the Homer-Ellen-Greta triangle. At that time they were not yet all living together, but I still didn’t trust them. While Jake was supposedly on watch, Greta balled his brains out. ‘To celebrate,’ he said, when he apologized to me for falling asleep afterwards. When I woke up, more than half of the treasure was gone.”

Anger long buried was seething in Nick. Carol watched him carefully, noting the intensity of his passion. “Jake didn’t give a shit about the money. He even tried to talk Amanda and me out of going to court. That’s the kind of guy he was. I remember he told me, ‘Hey, Nick, my friend, we made two hundred thousand apiece out of this. We cannot prove there was more. Let’s just be thankful and get on with our lives.’ Homer had cheated him and Greta had shit all over him, but Jake still wasn’t pissed. Not much more than a year later, he married a water ski queen from Winter Haven, bought a house in Orlando, and went to work as an aerospace engineer.”

The light was vanishing outside. Nick was deep in a memory, recalling the full measure of his storm of righteous indignation from eight years before. “I’ve never understood them,” Carol said quietly. She switched off the recorder. Nick turned and looked at her, a quizzical frown on his face. “You know,” she added, “the people like your friend Jake. Infinite resiliency. No harbored grudges. Whatever happens to them they just shake off, like water, and go on living. Cheerfully.” It was her turn to feel a little emotion. “Sometimes I wish I could be more like that. Then I wouldn’t be afraid.”

They stared at each other in the soft light. Nick put his hand over hers. And there’s that vulnerable little girl again. He felt a deep emotional longing stirring in his heart. She’s let me see it twice in a single day. “Carol,” he said gently, “I want to thank you for this afternoon. You know, for sharing your feelings with me. I feel like I saw an entirely different Carol Dawson.”

“You did,” she said, smiling and making it clear that her protective shield was going up again. “And only time will tell if it was a huge mistake.” She pulled her hand slowly away from his “For the moment, though, we have other business. Back to the menage a trois. What kind of facility is it that they manage and what do they do there?”

“Excuse me?” replied Nick, obviously confused.

“A friend of mine, Dr. Dale Michaels of the Miami Oceanographic Institute, told me that Captain Homer and Ellen have some kind of high-tech operation here. I don’t remember exactly how he described it — ”

“You must be mistaken,” Nick interrupted. “I have known them for almost ten years and they are never anywhere except in that fancy house of his or onboard the Ambrosia.”

Carol was puzzled. “Dale’s information is always correct. He just told me, yesterday in fact, that Homer Ashford had field tested the institute’s most advanced underwater sentries throughout the last five years and that his reports _ ”

“Hold it. Hold it.” Nick was leaning forward on the table. “I’m not sure I’m following you. Back up. This could be very very important.”

Carol started again. “One of MOI’s newest product areas is underwater sentries, robots, essentially, that protect aquaculture farms from sophisticated thieves as well as large fish or whales. Dale said that Homer contributes money for the research and then field tests the prototypes — ”

“Son of a bitch.” Nick was standing up. He was bursting with excitement. “How could I have been so stupid? Of course, of course.”

Now Carol was lost. “Would you mind telling me what’s going on?”

“Certainly,” Nick answered. “But right now we’re in a hurry. We have to go by my apartment to look at an old map and pick up another navigation system for the boat. I’ll explain everything on the way.”

Nick put his key card in the reader and the garage door opened. He pulled his Pontiac into his reserved spot and stopped the car. “So you see,” he was saying to Carol, “he knew that we wouldn’t find anything. He let us search both his house and the lot that he had bought for his new mansion, down at Pelican Point. We found nothing. At that time it was still hidden somewhere out in the ocean.”

“Did you look in the water around his new property at that time?”

“Yes, we did. Jake and I each dove there, on separate days. We found a very interesting subterranean cave, but no sign of any of the Santa Rosa treasure. But we must have given him the idea. I bet he moved the stuff there a year or two after Jake left. He probably figured it was safe by then. And he had doubtless worried himself sick that someone would discover the treasure out in the ocean. You see, it all fits. Including his involvement with underwater sentries.”

Carol nodded and laughed a little. “It certainly makes better sense than your idea that Troy was working for the Russians.” They opened the doors and climbed out of the car. “So how much do you think they have left?” Carol asked as they headed for the elevator.

“Who knows?” Nick answered. “Maybe they stole three million out of five.” He thought for a minute. “They must still have a bunch. Otherwise Greta would have split by now.”

The elevator doors opened and Nick pressed the button for the third floor. Carol heaved a big sigh. “What’s the matter?” he asked.

“I’m exhausted,” she said. “I feel as if I’m on a carousel that’s spinning faster and faster. So much has happened in the last three days. I’m not sure I could deal with much more. What I need now is a second wind.”

“Magic days,” Nick replied as they walked out of the elevator. “These are magic days.”

She looked at him with a curious expression. He laughed. “I’ll explain an old theory of mine later,” he said. He entered a sequence of numbers into the small plate on his door and the lock disengaged. Nick moved to the side with feigned gallantry and let Carol enter first. What she saw was chaos.

The place was a total shambles. In the living room, just beyond the kitchen area, all of Nick’s precious novels had been scattered randomly about on the floor, the couch, and the chairs. It looked as if someone had taken each book out of the bookcase, held it up and shook it (trying to find loose papers

perhaps), and then either dropped it or thrown it across the room. Nick pushed by Carol and stared at the destruction. “Shit,” he said.

The kitchen had been plundered as well. All the drawers were open. Pots, pans, and tableware were strewn on the counters and on the floor. To Nick’s right, the cardboard boxes containing his memorabilia had been pulled into the middle of the second bedroom. Their contents had been partially dumped onto the floor around them.

“What hurricane hit this place?” Carol asked as she surveyed the mess. “I didn’t expect you to be a good house-keeper, but this is ridiculous.”

Nick was unable to laugh at Carol’s comment. He checked the master bedroom and found that it also had been ransacked. He then returned to the living room and started picking up his beloved novels and stacking them neatly on the coffee table. He winced when he found his worn copy of L’Etranger by Albert Camus. The spine of the book was destroyed. “This is not the work of vandals,” he said as Carol knelt down to help. “They were searching for something specific.”

“Have you found anything missing yet?” she asked.

“No,” Nick replied, picking up another novel with a mutilated cover and shaking his head. “But the bastards have really screwed up my books.”

She stacked his Faulkner collection on the easy chair. “I can see why Troy was impressed,” she said. “Have you really read all these novels?” Nick nodded. Carol picked one up that had fallen under the television stand. “What’s this about?” She held up the book. “I’ve never even heard of it.”

Nick had just arranged another dozen books on the coffee table. “Oh, that’s a fantastic novel,” he said enthusiastically, forgetting for a moment that his condominium had just been trashed. “The whole story is told through this exchange of letters among all the principal characters. It’s set in eighteenth-century France, and the main couple, socially prominent and bored, cement their weird relationship by sharing details of their affairs. With other lovers of course. It caused quite a scandal in Europe.”

“That doesn’t exactly sound like your typical Harlequin romance,” Carol remarked, trying to commit the title of the book to her memory.

Nick stood up and walked into the smaller bedroom. He began to sort through the contents of the cardboard boxes. “There are things missing in here,” he called out to Carol. She stopped arranging books and joined him in the bedroom. “All my photographs of the Santa Rosa treasure and even the newspaper clippings are gone. That’s odd,” he said.

Carol was beside him on the floor, in front of the boxes. She frowned. “Is the trident still on the boat?”

“Yes,” he answered. He stopped rifling through the papers. “Down in the bottom drawer of the electronics cabinet. You think there’s a connection?”

She nodded. “I think that was what they were after. I don’t know why. It just seems right.”

Nick picked up a large yellow folder that had been on the floor and replaced it in one of the cardboard boxes. A photograph and some sheets of typing paper fell out. Carol picked up the picture while Nick scrambled after the papers. She studied the photo and read the French inscription. She was surprised to feel a twinge of jealousy. “Beautiful,” she commented. She noticed the pearls. “Also very rich and sophisticated. She doesn’t look like your type.”

She handed Monique’s photograph to Nick. Despite his attempt to be nonchalant, he was blushing. “That was a long time ago,” he mumbled as he hastily stuffed the photo back into the folder.

“Really?” Carol said, eyeing him carefully. “She looks as if she’s about our age. It couldn’t have been too long ago.”

Nick was flustered. He packed some more loose material in the boxes and glanced at his watch. “We’d better leave soon if we’re going to meet Troy at

your hotel." He stood up. Carol remained kneeling on the floor, looking up at him with a steady gaze. "It's a long story," he said. "Someday I'll tell you all about it."

Carol's curiosity was piqued. She followed Nick out of his condominium and into the elevator. He was still ill at ease. Bullseye, she thought to herself. I think I have just discovered a major key to Mr. Williams. A woman named Monique. She smiled as Nick motioned for her to precede him out of the elevator. And the man does love his books.

Carol's room at the Marriott had two entrances. The normal approach to the room was by way of the corridor that led to the lobby. But there was another door that opened on the garden and the pool. When she exercised in the morning, Carol always used the garden entrance.

Nick and Carol were talking casually but quietly as they came toward her room from the lobby. She pulled out her electronic card key just before they arrived. As she started to insert the card into the lock, they heard an unusual sound, like metal banging against metal, from the inside of her room. Before Carol could say anything, Nick shushed her by putting his finger to his mouth. "You heard it too?" she whispered softly. He nodded his head. Using gestures, he asked her if there was another entrance to the room. She pointed out the door to the hotel grounds at the end of the corridor.

Palm trees and tropical hedges covered most of the area to the east of the Marriott swimming pool. Nick and Carol left the walkway leading to the pool and crept up to the windows of her room. The venetian blinds were drawn but they could still see into the room through a crack under the bottom of the blinds. At first the room was completely dark. Then a solitary beam from a flashlight reflected for an instant off one of the walls. In that split second they saw a silhouetted figure in the neighborhood of the television set, but they could not identify him. The flashlight came on again and it paused for a moment on the door to the corridor. The door was bolted. In the brief flicker of the light beam, Carol also saw that all her dresser drawers were open.

Nick crawled over next to Carol in the flower bed just under the windows. "You stay here and watch," he whispered. "I'll go get something from the car. Don't let them know you're here." He squeezed her shoulder and disappeared. Carol stayed glued to the window. Once more the flashlight came on, illuminating electronic parts spread out on the far bed. Carol strained for a look at who was holding the flashlight. She couldn't see him.

She became acutely aware of the passage of time. Her intuition told her that the intruder was getting ready to leave. She suddenly realized she was completely exposed sitting out there underneath the window. Come on, Nick, she said to herself. Hurry it up. Or I may be chopped liver. The figure in the room moved toward the garden door and then stopped Carol felt her pulse rate increase. At just that moment Nick returned, out of breath. He had brought back a long crowbar from the trunk of his car. Carol motioned to him to stand by the door, that the intruder was about to come out.

She saw the figure put his hand on the doorknob and she flattened herself against the dirt. Nick was behind the door, poised to deliver a powerful blow to whoever exited from the room. The door opened, Nick started to strike. "Troy," screamed Carol from the flower bed. He jumped back just in time, barely missing the downward swoop of Nick's crowbar. Carol was on her feet in an instant. She ran up to a shaken Troy. "Are you all right?" she said.

His eyes were wide from fright. "Jesus, Professor," he said, glancing at the crowbar that Nick was wielding, "you might have killed me."

"Shit, Jefferson," Nick replied, the adrenaline still coursing through his system, "why didn't you tell us it was you? And what were you doing in Carol's room?" He looked at Troy accusingly.

Troy backed into the room and turned on the lights. The room was a disaster. It looked like Nick's condominium when Carol had first walked through the front door.

Carol turned to Troy. "Why on earth . . ."

"I didn't do it, angel," he replied. "Honest Injun." Troy looked at his two friends. "Sit down," he said. "This will only take a second."

Meanwhile Carol's eyes were scanning the room. "Crap," she said angrily, "all my cameras and film are gone. And virtually the entire telescope system, including the post-processor unit. Dale will shoot me." She looked in one of the open drawers. "The assholes took my photographs from the first dive as well. They were in a large envelope on the right side of this top drawer."

Carol sat down on the bed looking a little dazed. "All the film from the photographs that I took inside that place has been stolen. So much for my sensational story," she said.

Nick tried to comfort her. "Who knows. Maybe they'll turn up. And besides, yal still have all the negatives from the first dive."

Carol shook her head. "It's not the same thing." She thought for a minute. "Damnit," she said, "I should have kept the exposed film with me when we left the hotel to go to Troy's apartment." She looked at the two men and then brightened a bit. "Oh well," she said. "There's always tomorrow."

Troy was still waiting patiently to give his explanation. He indicated for Nick to sit down on the bed next to Carol. "I'll make this short and sweet," he said. "Just the facts. I arrived here about seven o'clock. I came early because I wanted to make some modifications to your television set. I'll explain why in a minute.

"The people in the hotel wouldn't give me a key to your room so I came down here and fooled the card reader." He smiled. "It's no problem for someone who knows how these things work. Anyway, as soon as the green light came on and the guard bolt released, I heard the garden door slam. Someone had been in the room while I was opening the door. I caught a fleeting glimpse of him as he hightailed it around the corner of the building. He was a big man, not someone I recognized immediately. He was moving with difficulty, as if he were carrying something heavy."

"Part of the ocean telescope," Carol said.

"Go on," added Nick. "What happened next? I want to hear why you were in Carol's room working in the dark. I bet you'll come up with a good story for that too."

"That's easy," Troy said to Nick. "I was afraid the thief or thieves might come back. I didn't want them to see me."

"You're amazing, Jefferson," Nick responded. "You're the kind of person who would tell a cop that you were exceeding the speed limit because you wanted to get to a filling station before you ran out of gas."

"And the cop would believe him," Carol remarked. They all laughed. The tension in the room was diffusing.

"All right," said Nick. "Now tell us what you've done to the television. Incidentally, how did you get inside it? I thought these hotel sets were all alarmed."

"They are," Troy replied, "but it's very simple to disable the alarm system. It always cracks me up. Somebody sells the hotel the idea that they can protect their property with these alarms. But the burglars can easily find out what system has been installed, buy the circuit data sheets, and completely disable the protection."

Troy glanced around the room. He then checked his watch carefully. "Let's see," he said. "Why don't you two move over here in these chairs. I think you'll be able to see better." Nick and Carol exchanged puzzled looks and arranged themselves as Troy had requested. "Now," he continued in a surprisingly serious tone, "you will see what I believe is incontrovertible

proof that my story about the aliens is true. They have told me, through this bracelet, that they are going to televise a short program from inside the vehicle at exactly seven-thirty. If I have translated their directions properly and made the correct modifications, this television should now be able to receive their transmission."

He turned on the set and put it on channel 44. There was nothing but snow and static. "This is great, Troy," Nick commented. "It will probably steal rating points from soap operas and music videos. Watching this requires even less intelligence — "

A picture suddenly appeared on the screen. The lighting was poor, but Carol immediately recognized herself in the scene. She was standing with her back to the cameras, her fingers moving around on top of what appeared to be a table.

An orchestral version of "Silent Night," featuring an instrument not unlike an organ, accompanied the picture.

"That's the music room I told you about," Carol said to Nick. "I guess that warden thing had a video camera in all his paraphernalia."

The television scene switched immediately to a close-up of Carol's eyes. For five seconds her marvelous, frightened eyes filled almost the entire screen. She blinked twice before the camera pulled back and revealed her in front view. terrified, standing and shaking in her bathing suit. Carol shuddered as she recalled the horror of those seconds when the warden's appendages intruded upon her person. It was all shown in the video, some parts even in slow motion. One of the featured scenes was the deliberate movement of the bristles across her chest, including both her erect nipples. Oh my God, she thought. I hadn't realized they were erect. Maybe fear does that. Carol squirmed. She felt surprisingly embarrassed in front of Nick.

There was a jump discontinuity in the program. In the next scene the three of them were looking at Troy, lying on his back on the floor somewhere, with enough wires and cords attached to him that he could have been Gulliver bound by the Lilliputians. The camera panned around the room. Two wardens were in one of the corners. Their upper body attachments were not even similar, but they both had the same central body, amoebalike, that had confronted Troy and Carol. On the other side of the room a pair of carpets were standing together. From their motions it looked as if they were engaged in a conversation. Nick and Carol and Troy watched while the camera stayed fixed for about ten seconds. The carpets apparently finished conferring and then flipped off in separate directions.

The final frames of the transmission were a close-up of Troy's head showing more than a hundred probes and inserts connected to his brain. Then the screen went back to snow and static. "Wowee," said Nick after a moment. "Can I have an instant replay?" He stood up from the bed. "You were terrific," he remarked to Carol, "but I think your scenes will have to be edited if we want a PG rating."

Carol looked up at him and blushed slightly. "Sorry, Nick, but I don't think you make a good comedian. We have one already," she nodded at Troy, "and I think that's enough." She glanced at the clock beside her bed. "Now I figure we have fifteen minutes or so to make plans. No more. And I have to dress as well. Why don't you tell Troy about your decision and what you have concluded about the Santa Rosa loot while I change my clothes." She grabbed a blouse and a pair of pants and headed for the bathroom.

"Hey, wait a minute," Nick protested. "Aren't we going to discuss who it was that broke into my condominium and your hotel room?"

Carol stopped outside the bathroom door. "There are only two possibilities that make any sense," she said. "It's either the Navy or our sicko friends from the Ambrosia. Either way we'll find out soon enough." She stopped a moment and an elfin smile played across her lips. "I want you two to

see if you can figure out a way to steal Homer's gold. Tonight. Before we go back to meet with our extraterrestrials tomorrow morning."

9

CAROL and Troy went over the details one last time and she checked her watch. "It's eight-thirty already," she said. "If I'm much later I know they'll be suspicious." She was standing outside Nick's Pontiac in the parking lot of the Pelican Resort, a restaurant about three-quarters of a mile from the Ashford mansion at Pelican Point. "Where is he?" she fretted. "We should have finished with this fifteen minutes ago."

"Just calm down, angel," Troy replied. "We have to test this new unit first. It could be very important in an emergency and I've never actually used it." He gave her a reassuring hug. "Your friends at MOI originally developed it."

"Why did I have to suggest such a wild-ass idea?" Carol said out loud to herself. "Where's your brain, Dawson? Did you leave it in the . . ."

"Can you hear me?" Nick's garbled voice interrupted her. It sounded as if it were coming from the bottom of a well.

"Yes," Troy answered into a tiny walkie-talkie shaped like a thimble. "But not too clearly. How deep are you?"

"Say again," said Nick. "I did not copy completely."

"Yes, we can hear you," Troy shouted. He carefully enunciated each word. "But not very clearly. You must speak slowly and distinctly. How deep are you?"

"About eight feet," was the response.

"Go down to sixteen and try it again," said Troy. "Let's see if it will work from the deepest part of the cave."

"How's he doing that?" Carol asked, while they waited for Nick to descend.

"It's a brand-new system, built into the regulator," Troy answered. "You have to speak while you're exhaling for it to work. There's a small transmitter/receiver inside the mouthpiece and an earphone attachment. Unfortunately, it doesn't work much below ten feet."

Almost a minute later Carol and Troy heard something, very faint, not even recognizable as Nick's voice. Troy listened for a moment. "We cannot read you, Nick. There is too much attenuation. Come on back now. I'm going to send Carol on her way." Troy pressed a button on the walkie-talkie that would repeatedly transmit this last message.

He handed the communications unit to Carol. "Okay, angel," he said, "you're ready. We should be in the water around nine o'clock and out, if all goes well, by half an hour later. Keep them occupied with your questions. You should leave by ten-thirty at the latest and drive directly to Nick's apartment. We will meet you there with your wagon." He raised his eyebrows. "And the gold, I hope."

Carol took a deep breath. She smiled at Troy. "I'm scared," she said. "I would rather face a carpet or even one of those warden things than this trio." She opened the car door. "Do you really think I should go in Nick's car? Isn't that certain to make them suspect something?"

"We've been through all this twice before, angel," Troy laughingly replied. He gently nudged her into the car. "They already know we're friends. Besides, we need your wagon for the diving gear, the backpacks, and the lead and gold." He closed the door and planted a light kiss on her cheek through the open window. "Be safe, angel," he said. "And don't take any unnecessary chances."

Carol started the car and backed into the middle of the parking lot. She waved at Troy and pulled into the dark lane that led through the marsh to the

end of the island. The only light was from the nearly full gibbous moon that was already above the trees. All right, Dawson, she thought to herself. Now you're in the middle of it. Just stay calm and alert.

She drove very slowly. She reviewed the plans for the evening several times in her mind. Then she started thinking about Nick. He holds on to things. Like I do. He still hates Homer and Greta for cheating him. He couldn't wait to dive for the gold. She smiled as she turned into the circular drive in front of Homer Ashford's house. I just hope there is some left over for him.

A split second after Carol rang the doorbell, Homer opened the door and greeted her. "You're late," he said in a pleasant monotone. "We thought maybe you were not coming. Greta is already in the pool. Do you want to change and join her?"

"Thanks, Captain Homer, but I decided not to swim tonight," Carol answered politely. "I appreciate the offer, but I'm mostly here on business. I would prefer to start the interview as soon as possible. Even before dinner, if that would be all right with everyone else."

Homer led Carol into a gigantic family room and stopped by a large wet bar. A magnificent hand-carved wooden statue of a swimming Neptune, about four feet long altogether, was on the wall above the bar. Carol asked for some white wine. Homer tried without success to talk her into something stronger.

The family room had a billiards table at one end. On the other side, a sliding glass door opened onto a covered patio that narrowed into a cement walkway. Carol followed Homer in silence, sipping from her white wine every twenty steps or so. The walkway wound past big trees and a lighted gazebo off to the left before it spread out around the huge swimming pool.

Actually there were two pools. In front of Carol was a classic, rectangular, Olympic-sized pool under strong lights. At one end was a slide and waterfall that ran down an artificial mountain into the swimming area. At the other end, in the direction of the second pool and the ocean, there was a sunken Jacuzzi constructed out of the same decorated blue tiles that rimmed the top of the main pool. The entire complex was cleverly designed to create the impression of moving water. There seemed to be a steady flow from the waterfall, to the large pool. down into the Jacuzzi, and then into a stream that meandered off in the direction of the house.

The second pool was circular and dark. It was off to Carol's left at the edge of the property, near what looked like a small cottage for changing clothes. Greta was in the rectangular pool in front of Carol. She was swimming laps, her powerful body moving rhythmically through the water. Carol, who was an excellent swimmer herself, watched Greta for a few seconds.

"Isn't she something?" Homer walked over next to Carol. His admiration was obvious. "She won't let herself eat a big meal unless she works out beforehand. She can't stand fat."

Homer was wearing a light brown Hawaiian shirt with a pair of tan slacks. Brown loafers were on his feet, and a big drink, crammed with ice cubes, was in his hand. He seemed relaxed, even affable. Carol thought he could have passed for a retired banker or corporate executive.

Greta continued to swim relentlessly through the water. Homer was hovering over Carol and she was beginning to feel uncomfortable, as if her space were being invaded.

"Where's Ellen?" she asked, turning to the large man and moving just slightly farther away from him.

"She's in the kitchen," Homer replied. "She loves to cook, especially when we have guests. And tonight she's making one of her favorite dishes." There was almost a twinkle in his eye. He leaned down to Carol. "She made me promise not to tell you what we're having," he whispered confidentially, "but I will tell you that it's a powerful aphrodisiac."

Ugh, said Carol to herself as she caught a whiff of Homer's breath and listened to his leering chuckle. How could I have forgotten how repulsive this man is? Does he really think that . . . Carol stopped her thought. She reminded herself that people with excessive money very often lose touch with reality. Probably some of the women respond. For what he can give them. She almost gagged. The thought of having any kind of sexual liaison with Homer was totally repugnant.

Greta had finished swimming laps. She climbed out of the pool and dried herself off. Her all-white racing uniform was like a transparent body stocking. Even from a distance, Carol could not avoid seeing the full detail of her nipples and breasts as well as her clump of pubic hair through the thin suit. She might as well have been naked. Homer stood beside Carol, unabashedly staring as Greta strode across the cement.

"No suit?" Greta said just before she reached them. Her eyes were trying to bore holes in Carol's. Carol shook her head. "I'm sorry," said Greta. "Homer had hoped that we might have a race." She looked at the captain with an odd expression that Carol did not understand. "He loves to see women in competition."

"It would have been no contest," Carol answered. She thought she saw Greta tense. "You would have won easily," she added. "You swim beautifully."

Greta smiled, accepting the compliment. Her eyes roamed over Carol's body. She made no effort to hide the fact that she was doing an appraisal. "You have a good body too for swimming," Greta said. "Maybe a little too fat on the ass and upper legs. I could suggest workout — "

"Why don't we show Miss Dawson the other pool?" Homer interrupted. "Before you go inside and change clothes." He started walking toward the little cottage near the ocean. Without saying another word, Greta turned and followed him. Carol took a sip from her wine. Who knows what goes on here, she thought . Those three have not had to work for eight years. They take people out fishing and diving for amusement. A strange mixture of disgust and depression started to spread in her. So they manufacture entertainment to keep from being bored.

Moments after Homer entered the cottage, a bank of flood-lights down underneath the second pool was illuminated. Homer gestured for her to hurry and Carol skipped into the cottage. They led her down a flight of steps. Under the ground was a walkway that completely encircled the large glass aquarium that had looked, in the darkness, like a second swimming pool. "We have six sharks now," Homer said proudly, "as well as three red occi, a pair of cuttlefish, and of course hundreds of more standard species of fish and plants."

"Occi?" inquired Carol.

"That's the slang plural of octopus," Homer responded with a smug, self-satisfied smile. "Actually, the correct plural is octopodes, even though everyone now accepts octopi because it has been used so much."

Greta was standing with her face pressed against the glass. A couple of bat rays swam past. She was waiting for something. After twenty seconds or so a grayish shark appeared. The shark seemed to notice Greta and stopped, watching her, its face about five feet away from the glass. Carol could see the long sharp teeth and identified it as a mako, a fierce smaller cousin of the man-eating great white shark.

"That's Greta's pet," said Homer. "His name is Timmy. Somehow she has trained him to recognize her face against the glass. " Homer watched a few more seconds. "From time to time she goes in there to swim with him. When the sharks have finished eating, of course."

The shark remained in place, staring blankly in Greta's direction. She began to drum her fingers against the glass in regular cadence. "Now this is exciting," Homer said, walking over next to Greta and the aquarium. "What you

are going to see is what biologists call a typical Pavlovian response. I've never seen it quite this way before in a shark."

The mako began to be agitated. Greta started increasing the tempo, the shark responding by whipping the water back and forth with its tail. Suddenly Greta disappeared up the stairs. Carol thought she noticed a faraway look in her eyes when Greta zoomed by her. Carol looked at Homer for an explanation. "Come down here closer," he gestured to Carol. "You don't want to miss this. Greta cares for the rabbits herself. And Timmy always puts on a grand show."

Carol wasn't exactly sure what Homer was talking about. But she was enjoying the lovely aquarium. It contained crystal-clear sea water, obviously filtered and recycled regularly. Carol noticed several species of sponges and coral, as well as urchin and anemone. Someone had gone to great trouble and expense to re-create the conditions in the reefs just off-shore Key West.

Suddenly a beheaded white rabbit impaled on a long vertical staff, the blood still spurting from its arteries, appeared in the aquarium just opposite where Carol and Homer were standing. It was over in an instant. Driven to immediate frenzy by the blood in the water, the mako attacked, its teeth ripping half the hapless rabbit off the stave with the first bite. The second swoop captured the rest of the rabbit and snapped the rod as well. Carol barely had time to recoil and turn her head. When she jumped back, she spilled wine all over her blouse.

Trying to appear calm, she reached in her purse for a tissue to wipe her blouse. She said nothing. She had had a perfect view of the shark's attack and could still feel the adrenaline imbalance that the fright had produced. Great way to start a dinner party, she thought. Why haven't I ever thought of it? Dawson, these people are weird.

Homer was still excited. "Wasn't that spectacular? Such raw, savage power in those jaws. Driven by pure instinct. I never get tired of it."

Carol followed him up the stairs. "Good show, Greta," she heard Homer say when they walked out of the cottage. "It was right in front of us. Two bites. Wham, wham, and the rabbit was gone."

"I know," said Greta. She was holding a diving mask. What was left of the staff was on the ground beside her. "I could see from up here." Greta was staring at Carol, obviously trying to discover her reaction. Carol averted her eyes. She was not going to give Greta the satisfaction of knowing she had found it repulsive.

"Greta has the whole thing down to split-second timing," Homer continued as they walked back through the gardens to the house. "She prepares the live rabbit on the chopping block an hour early. Then, when Timmy is ready, she . . . ."

Carol tuned his gruesome story out of her mind. I don't want to hear this, she thought. She glanced at her watch. Ten minutes after nine. Come on guys. Be swift. I'm not certain I can stand these people for another hour.

Nick and Troy swam silently along the shoreline in the moonlight. They had carefully rehearsed the plan. No additional light until they were in the cove beside Homer's property and at least ten feet under water. Troy would lead, searching for alarm systems he could disable with the tools stuffed in the pockets of his wet suit. He would also keep a lookout for the infamous robot sentries. Nick would follow with the buoyancy bags they would use to carry the gold.

They had walked along the beach from the Pelican Resort parking lot, wearing their heavy diving suits as well as the backpacks, until they were only about a hundred yards from the thick fence that marked Homer's property. Then they had set down the packs containing their clothes and eased into the water. During the walk Troy had had several problems with his tools, and a decision to reduce his arsenal of gadgets had delayed their arrival at the embarkation point

by five minutes. Just before they went into the water, Nick had given an uncharacteristic squeal of excitement and grabbed Troy by the shoulders. “I hope that fucking gold is there,” he had said. “I cannot wait to see their faces after we steal it.”

It was time to submerge. Holding hands in the darkness, Nick and Troy dropped about five feet under the water. They stopped, equalized the pressure in their heads, and repeated the procedure. When they were down about ten feet, Troy turned on the searchlight. They quickly worked out their directions and headed around the corner, deeper into the cove adjoining Homer’s estate.

Troy was in the lead. He had no trouble finding the entrance to the natural tunnel that led to the subterranean cave. As they had planned, Nick waited outside the tunnel while Troy went inside to look for alarms. The rock cliffs closed over his head. The watery entryway was about five feet across and four feet high. Troy immediately found a metal box affixed to the left wall, where it was partially hidden from view. When he examined the box, he discovered that it was emitting two laser beams separated by about three feet.

On the other side of the natural tunnel were the receiving plates for the beams as well as the alarm electronics. Troy swam over carefully, pulled out his screwdriver, and dismantled the housing. The system was very simple. Failure of either plate to receive a beam would trigger the opening of a relay. When both relays were open, current could flow to the alarm. Thus an object had to be large enough to break both beams simultaneously to set off an alarm. Troy smiled to himself as he validated the operating principle by passing his hand in front of one of the beams. Then he jerryrigged one of the relays permanently closed. Satisfied with his work, he swam back and forth in the tunnel, breaking both beams at the same time, assuring himself that he had rendered the alarm system ineffective.

He swam back out to meet Nick and gave him the thumbs-up sign. The two men passed through the fifty yards of natural tunnel into the subterranean cave. Where the narrow passageway widened, Troy again gestured to Nick to remain behind while he, Troy, went into the cave to check for booby-traps. Nick let his feet fall to the bottom of the tunnel and switched on his own small flashlight. He was in a perfect place for an ambush. The tunnel was so small here that there was virtually no maneuvering room He wondered what an underwater sentry would look like. What a place to die, he thought suddenly. Fear swept over him as he turned off his flashlight and looked down at his illuminated diver’s watch. He watched the glowing second hand sweeping around the face. He tried to calm himself. It had been three minutes since Troy had left. Why is he taking so long? he asked himself. He must have found something. Another minute passed. Then another. Nick was having a hard time quelling the onset of panic. What do I do if he doesn’t return?

Just as Nick was about to swim into the cave on his own, he caught sight of Troy’s searchlight coming toward him Troy waved and Nick followed. Within thirty seconds they were in the shallow part of the cave, where the water was only about four feet deep. The two men stood up with their flippers lodged against the rocks to protect themselves from falling in the intermittent tidal surges.

Nick pulled his regulator out of his mouth and flipped his mask back on his head. Before he could speak, Troy put a finger against Nick’s lips. “Speak very softly,” Troy’s whisper was barely audible. “The place could be alarmed for sound as well.”

There was no light in the cave except Troy’s searchlight. However, over their heads, in the highest corners of the rock ceiling, Troy pointed out two separate banks of fluorescent lighting. The cave itself was an irregular oval, about thirty yards in its longest dimension and maybe fifteen yards across at its widest point. The ceiling was only about three feet above the water near

the entrance to the tunnel out to the ocean, but it was twenty feet high in the corner where they were standing in the shallow water.

"Well, Professor," Troy continued whispering, "I have good news and bad news. The bad news is that there is no treasure here in this cave. The good news is that there are two other tunnels, both manmade, that lead away from this place and go under Captain Homer's property." He paused for a moment and watched his partner. "Shall we go for it?"

Nick looked at his watch. It was nine-twenty already. He nodded. "The bastard spent a lot of money down here. They must have stolen more than I figured." Nick adjusted his diving equipment.

"We'll start with the tunnel on the left. As before, I'll lead to look for trouble." Troy cast his searchlight around on the ceiling. "This is a strange place. But beautiful. It looks like another planet, doesn't it?"

Nick pulled his mask back over his face and slipped the regulator in his mouth. He flopped backward into the sea water. Troy followed and, once under the surface, showed Nick the way to the first manmade tunnel. This tunnel was on the other side of the cave, about twelve feet below the water at its lowest point. It was made of normal circular sewer pipe. The diameter of the pipe was about five feet, making the tunnel approximately the same size as the natural passageway between the ocean and the cave. Troy entered the tunnel gingerly. He swam back and forth from side to side, examining one wall for a few yards and then going across to the other. He almost missed the long, slender alarm box. It was embedded in the ceiling at a junction between two sections of sewer pipe and Troy just happened to look up before he triggered the alarm.

This system worked on a different principle. A camera or other optical device in the box on the ceiling took repeated images of a square foot of the tunnel bottom that was backlit by an illuminated square cleverly concealed below the normal concrete floor. Apparently some kind of data comparison algorithm in the alarm processor contained logic by which the consecutive pictures could be assessed, in terms of threat, and an alarm triggered if necessary. It was the most complicated device of its kind that Troy had ever seen and he quickly recognized the similarities between this system and the ocean telescope that had been onboard the Florida Queen. That means MOI designed and developed it, he thought to himself. So I'd best be careful. I bet the algorithm is set so that disturbances to the camera trigger the alarm as well.

Nick had swum over to the side of the tunnel, out of the way, and was watching Troy try to open up the alarm box without jiggling the optical instrument. To accommodate the almost two-inch width of the box, there was a gap of that size everywhere around the circle connecting the two sequential sections of pipe. Throughout the rest of the tunnel, all adjoining sections were cemented together. Here the passageway was discontinuous.

Curious, thought Nick. He idly shone his small flashlight into the blackness in the gap beside him, expecting to see nothing but a wall of rock. What in the world is that? he wondered, as his light fell upon some metal object that looked like a large grating. The grating was resting upon an old piece of railroad track. Nick looked more carefully. He could make out a gear box and some pulleys, but he had no idea how all these mechanical devices fit together.

Meanwhile Troy had managed to remove the housing from the alarm box without disturbing the camera and was busy trying to understand the inner workings of the system. Whew, he thought. This is much too complicated to figure out in five minutes. If I can just isolate the alarm, that should be enough. It was tough work under the water. But Troy was clever and the electronics were packaged in a logical fashion. He was able to find the alarm and disable it. Afterward Troy lingered for several seconds trying to determine the purpose of the other circuits connected to the alarm subassembly.

Nick had intended to show Troy what he had found in the gap; however, as he watched his friend struggling with the complex circuitry of the alarm box, he

became again worried about the passage of time. It was now almost a quarter to ten. He caught Troy's eye and pointed at his watch. Troy reluctantly abandoned his investigation of the alarm and proceeded down the tunnel.

Thirty yards farther the tunnel passed what looked like a door to a submarine on their left. Both Troy and Nick tried pulling on the handle of the large and very heavy round door but nothing happened. With gestures Troy told Nick to continue trying to open the door while he swam on down the tunnel.

The gold bars and other objects that remained from the Santa Rosa treasure were sitting in the tunnel another thirty yards beyond the round door. The passageway itself came to an abrupt halt against a rock wall. In front of the wall was an array of gold and silver objects, stacked to an average depth of a foot or so across the width of the tunnel. The treasure was not hidden in any way, it was simply scattered in random piles on the concrete floor at the end of the tunnel. Troy was ecstatic. There's plenty here, he thought. Enough for the aliens. Enough for Nick. Maybe even some left over for Carol and me.

He swam back to find Nick. Nick was absolutely exultant when he saw the unmistakable smile on Troy's face. He raced around his friend to the end of the tunnel When Nick first reached the treasure, he spent a minute or two swimming around, picking up each object that was different and dropping it back into the piles on the floor.

Holy shit, Nick said gleefully to himself as he and Troy started putting gold bars into the buoyancy bags. I was right for once. There must be over a hundred pounds in bars alone. They had agreed before the dive just to bring out the bars, provided there were enough. The bars were the only objects they could be certain were pure gold. Even if we take fifty-eight to Troy's friends, that might leave fifty or so for us. He did a quick mental calculation. That could be over three hundred thousand dollars apiece. Whoopee.

Joy and excitement surged through Nick. He was having difficulty containing himself. He wanted to sing, to dance, to jump with joy. He had been right after all. The bastards had stolen most of the treasure and now he was stealing it back. There's no happiness quite like the redressing of an old and painful grievance. And to do it with panache . . . Nick was already celebrating in his heart. This was his day.

Filling the bags took no time at all. Nick and Troy both felt as if they had infinite energy. When they had finished picking up the gold bars, Troy gestured down the tunnel. Nick looked down at the other treasure objects remaining on the floor. We should take it all, he thought. We should leave Homer and Greta nothing. Nothing at all. But he had to be practical. Each of their bags was virtually full and they would be heavy enough as they were.

Nick swam off in the direction of the ocean, his buoyancy bag full of gold trailing behind him. Troy followed. As they passed the bulky door on the right, Troy found himself thinking again about the circuitry leading to the alarm in the box just ahead, between the two sections of pipe. What could those other connections be for? Suddenly he remembered seeing a diagram in an electronics magazine about advanced timers that could reinitialize systems and swap out failed parts. By now the component that Troy had disabled might have been declared a failure by the smart processor in the alarm box, in which case it would have either been replaced by a redundant part or the system would be ignoring its output. In either situation, Troy thought, that means the system could be active again.

It was too late. Nick swam into the field of view of the optical device and lights came on throughout the tunnel. A metal gate started closing behind Nick and his bag of gold. It was only with a burst of speed that Troy propelled himself through before the gate shut completely. But his buoyancy bag full of gold bars was left behind, on the other side of the gate.

Nick stared at Troy's lost bag as it floated to the floor. He reached through the bars, grabbed the bag, and tried to pull it through. It was

useless. He shook the gate. The metal was extremely sturdy. Angry and frustrated, he punched the gate with his fists. As Nick caught his breath in between punches, he became aware of a strange droning sound, like a motor, somewhere in the distance behind him. He turned around to find Troy. He could not see him anywhere.

Troy had been exhausted by his swimming sprint through the closing gate. His energy spent, he had let himself fall to the floor of the pool in the deepest part of the cave, halfway between the two manmade tunnels. He took several deep breaths through his mouthpiece and checked his air supply. He had about ten minutes remaining. He watched for a moment as Nick, almost out of sight to his right, tried fruitlessly to pull Troy's bag through the gate. Shit, Troy thought, disappointed that he had lost the gold, if only I had been thinking. I should have known . . . He heard an unusual sound off to his left. Curious, Troy swam over to the entrance of the other tunnel and right into the path of the robot sentry.

Even though the original distance between them was over fifty feet, the guidance mechanism of the sentry fixed on Troy as soon as he appeared. Startled and fascinated, at first Troy did not try to avoid the onrush of the bullet-shaped submarine. The sentry was three feet long and a foot wide in its midsection. When it was about eight feet away, the sentry slowly loaded and fired a small but powerful spear, the size of a table knife, that Troy just managed to avoid as it hurtled past. The spear crashed into the wall beside him.

Adrenaline surged into Troy's system and he swam out into the middle of the pool. The sentry did not follow him immediately. Instead it moved over in front of the natural passageway to the ocean, thereby cutting off the escape route, and then turned around to make a systematic search of the pool . Damnit, Troy was thinking, why didn't I leave while I had the chance? He wondered if Nick was still over by the gate.

The sentry had now found Nick in its field of vision. He was swimming slowly toward the exit with his buoyancy bag. He was unaware that he and Troy were not alone in the pool. By the time Nick saw the sentry, he was fifteen feet away and within easy range of its underwater gun. Troy watched the sentry load a spear. Oh no, he cried out to himself. Watch out, Nick. There was nothing he could do.

It happened so fast that neither Nick nor Troy knew exactly what occurred. Troy would later explain that he felt a sudden warm tingle on his wrist and then something, a light beam or a laser burst or a stream of plasma perhaps, fired out of his bracelet and zapped the robot sentry into silence and motionlessness. Nick would say that the sentry, just when it was going to fire at him, was first distracted by Troy and then recoiled as if from an impact. Whatever happened, the sentry stopped all activity. Immediately thereafter the two men swam together over to the shallow part of the cave. They were temporarily safe.

Carol could not believe how plump and succulent the oysters were. Ellen was sitting at the other end of the table opposite her, and was beaming with pride. "Would you like some more, dear?" she smiled, lifting the huge pot containing the oyster stew. I'm now going to eat a second portion, Carol thought. In addition to the catfish with Nick. Greta would be disgusted. She smiled to herself and nodded at Ellen. There was at least one thing she had learned this evening. Ellen was certainly a fantastic cook.

And a very sad person too, Carol thought as she spooned herself some more spicy stew rich with the fabled Appalachicola oysters. Homer had personally answered all the questions during the twenty-minute interview before dinner. Whenever a question had been controversial or delicate, such as when Carol had asked about the allegations that part of the treasure haul had been secretly stolen and hidden by the three of them, he had looked only at Greta before he

made a response. No wonder Ellen eats all the time. She's the odd man out. Or is it woman?

"This stew is fabulous," Carol remarked to Ellen. "Would you mind giving me the recipe?"

Ellen was delighted. "Certainly, dear," she said, "it would be my pleasure." Carol remembered Dale's reference to Ellen's behavior at the MOI awards dinner and wondered if there was, indeed, any sexual component to the warmth Ellen was displaying. I don't see it, Carol decided. This is just a lonely and profoundly disturbed woman. I don't feel one iota of sexual tension.

"You've been asking the questions all evening, Miss Dawson," Homer was saying. "Now why don't we ask you a few?" He had been surprisingly pleasant and subdued since the bizarre preprandial shark feeding. They must be normal sometimes, Carol thought. Otherwise they couldn't survive. But who knows when Mr. Hyde will show up again.

"Ya," Greta said. It was the first time she had spoken directly to Carol during the meal. "Homer told me you were with Dr. Dale. You are lovers, no?"

You don't beat around the bush, do you Greta. Carol partially evaded the question. "Dale Michaels and I are very good friends. We spend quite a lot of time together, both socially and professionally."

"He is a smart man," Greta said. Those clear eyes stared at Carol and a smile played at the corner of Greta's lips. What is she trying to tell me?

The conversation was interrupted by the sound of a sharp alarm. Carol knew immediately that something had gone wrong. "What in the world is that?" Carol asked innocently as the strident alarm continued with its loud bursts.

Homer and Greta were already up from the table. "Excuse us," Homer said, "it's our burglar alarm. Probably an error. We'll go check it out."

They hurried out of the dining room, leaving Carol and Ellen alone, and headed down a nearby hallway. I must follow them and find out what's going on, Carol thought, her heart and mind racing together. She sneaked a peek at her watch. It was five minutes past ten o'clock. They should have finished by now. "I'm going to the rest room," she said to Ellen. "Don't bother," she added, as Ellen started to explain the directions. "I'm sure I can find it myself."

Carol walked quickly into the hall and listened for sounds of Homer and Greta. Moving very quietly, she followed them until she was just outside a large den on the opposite side of the house. The door to the den was ajar. "It will focus in a second," she heard Homer say. There was a pause. "Shit," he shouted, "it looks like the gold bars are already gone. They must have moved very fast . . . The picture is really not very clear. Here, you take a look."

"Ya," said Greta. "The bars are gone, I think . . . But Homer, the gold would be very heavy. Maybe the thieves are trapped in the tunnel . . . Timmy could search for them."

"That would fix the bastards," Homer's nervous laugh sent chills down Carol's spine. She back pedaled slowly until she had retreated to the main foyer of the house. She heard an outside door slam in the direction of the den. They've gone out to turn the sharks loose. Jesus. I must warn Nick and Troy.

Carol walked into the nearest bathroom in the hallway, pushed the door closed, and turned on the water faucet. Then she flushed the commode and untaped the small walkie-talkie that was hidden inside her shirt. She put the unit right next to her mouth. "Mayday, mayday," she said. "They know you're there. You are in danger." She repeated the message and then pushed the button that would automatically recycle the communication several more times. I certainly hope this damn thing works, she thought.

She started to affix the tiny unit to the inside of her blouse again. While she was taping it down, she happened to look in the mirror. Her heart nearly stopped. Ellen was standing in the doorway, staring at her, the baleful

glare in her eyes indicating that she had seen and heard everything. She took a step toward Carol.

"Just hold it right there, Ellen," Carol said. Carol put her hands up. "I have no quarrel with you." The fat woman hesitated. "Homer and Greta only use you anyway," Carol added softly, "why don't you leave them and make a life for yourself?"

Anger broke across Ellen's face. Her eyes narrowed, her cheeks reddened, and she raised her huge fists to threaten Carol. "It's none of your damn business how I live my life," she said menacingly. She moved again in Carol's direction.

Carol grabbed the thick metal towel rack beside her and pulled with all her might. The bar sprung free from the wall, dumping two peach bath towels and a wooden end piece on the linoleum floor. Carol brandished the bar over her head. "Don't make me hit you," she said. "Just move aside and get out of my way."

Ellen did not slow down. Carol aimed carefully and struck her hard, on the right shoulder. The heavy woman collapsed.

"Greta," she wailed in a monstrous voice, "Greta, help me."

Still waving the bar from the towel rack, Carol walked carefully around Ellen and backed toward the door. Once in the hall, she sprinted to the family room and headed for the front door. Right beside the wet bar she was tackled from behind. Carol fell forward, hard, and smashed her nose on the carpet. She tried to squirm out of Greta's arms but it was impossible. She was pinned. A few drops of blood trickled out of Carol's nose and fell on the carpet.

Both women were breathing heavily. Carol managed to turn her body around so that she was facing Greta. She struggled vainly to free herself. Greta's strong arms slammed Carol's wrists against the floor. Greta bent down until her face was only inches away from Carol's. "You were trying to get away, ya, and just why vere you in such a hurry."

There was something feral in Greta's eyes. On impulse, Carol lifted her head and kissed Greta, full on the lips. Startled, her assailant's arms momentarily relaxed. That was all Carol needed. Gathering all her strength, she smashed the bottom of her palm into the side of Greta's head. Greta was stunned. Carol pushed her off and made a dash for the door.

Carol was already calculating when she ran out the front door and down the steps. Greta will be up in an instant, she thought. I won't have time to open the car door. I might as well run for it.

The German woman was only fifteen yards behind her, and gaining fast, when Carol turned onto the lane that led from Homer's house to the Pelican Resort. For ten years I have run three times a week. But this is the only time my life has ever depended on it. She tried to accelerate. Greta continued to close the gap. Carol was certain she was going to be caught at any minute. Once she thought she felt Greta's hand on her blouse.

But after two hundred yards Greta began to drop back. When she was a quarter of a mile from Homer's driveway Carol dared to look over her shoulder. Her pursuer was clearly struggling and was now fifty yards behind her. Carol felt a renewed burst of energy. I'm going to make it, she thought. I'm actually going to escape.

Greta slowed to a walk. Eventually Carol did too, but not until she was almost to the restaurant. Even then she continued to look back, to try to find her antagonist in the moonlight. Now I'll call a taxi, she was thinking, And go over to Nick's apartment. I hope that the two of them heard my warning and are safe.

She could no longer see Greta. She stopped and strained her eyes. She must have turned back, Carol thought. While she was looking back down the lane, a pair of very strong hands grabbed her shoulders. She spun around and stared into the laughing eyes of Lieutenant Richard Todd.

HE had purposely waited until all the rest of the actors had left the dressing room. The package itself was inconspicuous, about the size of a large bar of soap, wrapped in white paper with a dark red ribbon. You don't even know if it's from her, Winters thought as he pulled the bow on the ribbon. The commander was full of anticipation. The show had been even better tonight. And in the bedroom scene he had felt, for just a second, the touch of Tiffani's tongue against his lips. She didn't have to do that, Winters told himself, suspending for a moment all vestiges of guilt.

His hands trembled a little as he opened the package. It was a plain white box. Inside was a silver cigarette lighter simple but handsome, with the initials VW engraved on the outside at the bottom. His heart raced. So she does feel it too. Commander Winters felt a powerful burst of lust in his groin. Now he was imagining a scene no more than three or four hours in the future. He was taking Tiffani home and they were kissing at her front door. "Would you like to come in," she would say . . .

"I feel pretty . . . oh so pretty . . . I feel pretty and witty and gay . . ." He heard her singing as she came down the hall. She pushed open the door to his dressing room and twirled around. Tiffani's hair was stacked high on her head showing the lines of her elegant neck. The gold filigree along the top of the comb that the commander had given her blended in perfectly with the rich red and brown of her hair. Her dress was white, low cut, with her shoulders exposed except for tiny straps in the corners.

"Well?" she said with a big and eager smile. She turned around again. "What do you think?"

"You look beautiful, Tiffani," he replied. He stared at her with such intensity that she blushed.

"Oh, Vernon," she sighed, now changing her mood, "the combs are wonderful." She pulled a cigarette from his pack on the dresser table and lit it herself with his new lighter. She took a deep drag, her eyes fixed on his, and put the cigarette down in the ashtray. "I don't know how to thank you," she murmured.

She walked over to him and put her hands in his. "It's already been another wonderful evening." She put her left hand behind his head and reached up to kiss him. His heart was about to explode within his body. She could feel his arousal as her lips nestled softly against his. She pulled his head down to meet hers and subtly increased the pressure of her kiss. At length he put his arms around her and pressed her body against his.

Commander Winters thought he was going to drown in the pleasure of that kiss. Never had he felt such longing. He was certain he would gladly die in the morning if he could just continue to kiss her all night first. For a moment, as he let himself experience fully the rush of joy and love and lust, all his worries and despair were pushed aside. He wanted to wrap himself around Tiffani, somehow zip her inside his skin, and close out everything else in the universe.

Melvin and Marc had come to the dressing room to find the commander. They had not approached with stealth and were not even being especially quiet, but neither Tiffani nor Commander Winters heard them walk up. The two men could see the pair kissing through the open dressing room door. They looked at each other and reached out instinctively to touch hands for an instant. From their own experience they knew about the difficulty of love affairs outside the accepted norm.

Tiffani and Winters finally broke the kiss and she put her head against his chest. Her back was to the door. Winters opened his eyes and saw Melvin and Marc standing there in front of him. He blanched, but the director made a

gesture with his hands that said, “It’s all right. It’s your business, not ours.”

Melvin and Marc considerately waited several seconds so that it would look as if they had not arrived until after the kiss. The commander patted Tiffani on the shoulder and turned her around in a fatherly manner. “Great show, Commander,” Melvin said as he walked into the room. “And another super performance from you too, young lady.” He paused. Marc smiled his compliments and Tiffani unconsciously straightened out her dress. “There’s a Lieutenant Todd waiting outside for you, Commander,” Melvin added. “He says it’s urgent. He asked me to tell you to hurry.”

Winters face was creased with wrinkles. What in the world is he doing here? he thought. It’s after ten o’clock on a Saturday night. “Thanks, Melvin,” he answered. “Tell him I’ll be out in a few minutes.”

The director and his friend turned and left the dressing room. Tiffani reached over for the lit cigarette, whose ash had grown so long it had nearly fallen out of the ashtray. She inhaled and handed it to Winters. “Did they see us kissing?” she asked anxiously

“No,” lied Winters. But already he was realizing how untenable his fantasy was. Precious Tiffani, he thought. My teenage lover. We were lucky. But we cannot kid ourselves. We will be seen eventually. He looked into her eyes and saw the flame of adolescent passion. Again he felt the surge in his loins. He reached down and pulled her forcefully to him. And if the wrong person sees us, he thought as his lips tingled with her kiss, there is no limit to my risk.

Winters threw his cigarette down on the ground and stomped it out. He shook his head in disbelief. “You are telling me that you have taken those three into custody? And you’re holding them at the base?”

Lieutenant Todd was confused. “But sir, don’t you understand? We have an entire set of photographs. In three of them you can clearly see the missile. And there are other pictures that show the black guy in some kind of underwater structure down there in the ocean. Just as I had guessed. What more could we possibly need? We also caught them, red-handed no less, coming back from a dive with fifty pounds of gold bars in their backpacks. Fifty pounds!”

Commander Winters turned around and went back in the theater. “Go back to the base, Lieutenant,” he said disgustedly. “I’ll be there in five minutes.”

It was apparent that Melvin and Marc were just waiting for Tiffani and the commander before they locked up the theater and went to the party. “Can you take her over, Melvin?” he asked. “There’s a big mess out at the base tonight and it looks as if I will have to straighten it out.” The conversation with Todd had been sobering for Winters on at least two levels. First, it had reminded him that there was a real world out there, outside of the theater, a world that would not look kindly on a forty-three-year-old Navy commander having a sexual relationship with a seventeen-year-old high school student. Secondly, Todd’s astonishing announcement that he had indeed detained three civilians, one of whom was a well-known reporter, jolted the commander into realizing that his preoccupation with Tiffani had affected his work. I should never have let this thing get so far out of control, he thought. From here on out that lieutenant makes no move that I don’t personally approve.

“I’m sorry, Tiffani,” he said in a fatherly voice. He gave her an ambiguous hug and a light kiss on the top of her head. “I’ll come to the party as soon as I can.”

“Hurry or you’ll miss the champagne,” Tiffani said with a smile. Melvin turned off the lights in the theater. The four of them walked out the door.

Winters had parked down the street almost a block away. He waved to Tiffani as she climbed into Melvin’s car. I wonder if you will ever know, young lady, he thought. Know how close I came tonight to throwing everything away.

In his mind's eye it was twenty-four years before, on a cold night outside of Philadelphia, and he had just gone berserk and virtually raped Joanna Carr. Winters started his Pontiac and eased into the street. It would be so easy, he thought. Just one time to forget the rules and constraints. To dive into the water without looking first. He remembered his pact with God after he had spent the night with Joanna. So You kept Your part of the bargain. I guess And I became an officer and a gentleman. And a killer.

He winced. He turned the car past the swank Miyako Gardens and headed for the base. With great effort he forced himself to stop thinking about Tiffani and Joanna and sex. It's not enough that I have this trial with Tiffani. At the same time I am assigned a redneck lieutenant who runs roughshod over civilians in his attempt to prove some cockamamie . . .

Commander Winters stopped at a signal. Slowly, the full impact of what Todd had told him began to sink in. Jesus. I may be in trouble too. Unlawful entry. Wrongful detention. They'll throw the book at Todd . . . He eased his car through the intersection. He mechanically put a cigarette in his mouth and lit it. So I should be apologetic. But shit. That Dawson woman is a reporter. Bad bad news.

He had arrived at the base. He waved to the security guard and drove on to where Todd had said they were keeping the trio. Winters stopped in front of a plain white building situated on a small hill about fifteen feet above the street level. A nervous Lieutenant Roberto Ramirez was waiting at the edge of the road. He was holding two large, thick envelopes in his hands. Ramirez turned and called something toward the front door. Todd came out in a moment. He locked the door carefully, came down the steps, and walked toward the other two officers. Ramirez was already showing the photographs to Commander Winters when Todd joined them. The three men had a short but animated discussion.

"So what happened after you received my message?" Carol turned to the other two as soon as Todd disappeared out the door. They had not had many chances to talk in private since Todd and Ramirez had taken them into custody in the parking lot at the Pelican Resort.

"Troy was ready to split," Nick laughed. "But I thought your warning only referred to the robot sentry. And since he had been quiet for several minutes, I figured we were already safe. I was still really pissed off about the second bag of gold bars. So I hurried back over to the gate.

"I was concentrating so hard on finding a way to pull the bag through the opening that I must have been oblivious to everything else. Suddenly I felt Troy jerk me backwards. Maybe a second later two or three sharks, one definitely a mako, slammed hard into the gate. I was certain the gate was going to fall into pieces."

"Those sharks were really nasty, angel," Troy interjected. "And stupid too. The big one must have banged against the gate a dozen times before he gave up."

"The buoyancy bag with the gold bars was immediately ripped to shreds by the crazy sharks. They may even have swallowed most of the bars themselves. It was not fun being that close to them." Nick shuddered. "When I close my eyes I can still see that mako's teeth three feet away from me. I'll probably have bad dreams for years."

"I pulled Nick toward the ocean. I didn't want any part of those mean bastards and I didn't trust the gate to remain intact in case they launched another attack. We made it out in record time. Of course, neither of us expected to be greeted by the U.S. Navy when we returned to the station wagon." Troy paused. "This Todd character, what's his problem any way? He sure thinks he's a bad ass. Is he just pissed because the professor decked him last night?"

Carol smiled. She reached her left hand over and put it on Nick's leg just above the knee. Her hand remained there while she was talking. "Todd is

one of the naval engineers trying to find the lost missile. I'm certain that he and his men must have been responsible for the break-ins at Nick's apartment and my hotel room. Otherwise they wouldn't have detained us."

"What grounds do they have for holding us?" Nick inquired. He dropped his hand down and wrapped it around Carol's. "It's not against the law to have gold bars in a backpack. Don't we have rights as citizens that prevent this kind of thing?"

"Probably," Carol replied. She squeezed Nick's hand and then retracted her own. "But as a reporter, I find this part of our adventure extremely interesting. You can tell that Lieutenant Ramirez is very nervous. He wouldn't let Todd even ask us any questions until Commander Winters was contacted. And he has been very concerned about our comfort."

As if on cue, the front door opened and the three naval officers walked in. Winters was in the lead with the two lieutenants just behind. Nick and Carol and Troy were sitting on gray metal auditorium chairs on the left of a partitioned area that served as a waiting room for the larger offices in the rear of the building. Winters moved into the area and half leaned against the large gray desk opposite them.

"I'm Commander Vernon Winters," he said, his eyes meeting each of theirs in turn. "As Miss Dawson knows, I'm one of the senior officers on the base here. I am currently in charge of a secret project, code named Broken Arrow." He smiled. "I'm sure you are wondering why you have been brought to the base."

Winters reached out with his left arm and Ramirez handed him the infrared blowups that showed the missile in the most detail. He waved the photos at the three detainees. "One of the goals of project Broken Arrow is to find a Navy missile that has been lost somewhere in the Gulf of Mexico. Lieutenant Todd here believes, based on these photographs, that you know where that missile is. That is why he has acted to bring you here for questioning." Winters' voice rose in pitch and he began to wave his arms. "Now I'm certain I don't need to remind you that state-of-the-art weapons systems are what keep our nation free and secure — "

"Spare us the patriotic lecture and the histrionics, Commander Winters," interrupted Carol. "We all know that you are searching for a lost missile and that you think we may have found it. Sorry. We went out looking for it today but were unable to locate it again." She stood up. "Now you listen to me a minute. Your zealous lieutenant there and his men have broken more laws than I can count. In addition to kidnapping us, they have looted and vandalized my hotel room and Mr. Williams' apartment. They have also stolen some photographs and valuable equipment." She fixed Winters with a hard gaze. "You sure as hell better have good reason for dragging us down here or I swear I'll see to it that all three of you are court martialed."

Carol glanced at Ramirez. He was squirming. "In the meantime," she continued, "you can start by giving us an official, written apology, returning all our property, and making adequate payment for all the damages. In addition I want exclusive access to all Broken Arrow files from this moment on. If you don't agree to all these terms, you might as well prepare right now to read about the Gestapo tactics of the United States Navy in the next edition of the Miami Herald."

Uh oh, thought Winters. This is not going to be easy. This woman reporter intends to play the bluff and threat game. He pulled out a cigarette while he was thinking. "Would you please not smoke in here?" Carol broke into his train of thought. "We all find it offensive."

Damn these aggressive nonsmokers. He replaced the Pall Mall in the pack in his pocket. Winters had been thrown off at first by Carol's rapid attack, but he eventually regained his composure. "Now, Miss Dawson," the commander began a minute later. He looked away from the trio, in the direction of the front door. "I can understand why you might be upset by what has happened. I

will admit that our men may indeed have acted in an unwarranted manner while they were searching your rooms to find evidence. However . . .” Winters stopped in mid-sentence, turned around, and came back toward Nick and Carol and Troy.

“However,” he repeated. “We are talking about treason here.” He waited to let his threat register. “And I don’t need to tell you, Miss Dawson, that treason is serious business. Even more serious than journalism.” He hesitated again for effect and his voice became very stern. “If any of you have knowledge of the whereabouts of this missile and have conveyed that knowledge to a member of any foreign government, especially one viewed as inimical to our national interests, then you have committed treason.”

“What kind of dope have you been smoking, Commander?” Carol replied. “We freely admit that we’ve been looking for your missile. But that doesn’t make us spies. You have no case against us.” She glanced at Nick. He was admiring her performance. “I’m simply a reporter covering a story. This treason business of yours is pure fabricated bullshit.”

“Oh, yeah,” said Lieutenant Todd, unable to restrain himself. “Then where were these pictures taken?” He showed the photo of Troy in full diving regalia in the initial underwater room with the red and blue walls. He then turned and pointed to the backpacks sitting in the opposite corner of the room. “And what were your two friends doing with fifty pounds of gold after their dive tonight?”

“All right, man,” Troy remarked in an exaggerated manner. He took a step toward Lieutenant Todd. “All right. You’ve figured it out, haven’t you? We found the missile and sold it to the Russians for fifty pounds of gold.” His eyes widened as he looked at Todd. “And now the missile is onboard a submarine on its way to Moscow or wherever . . . Come on, man, get serious. We’re not that stupid.”

Lieutenant Todd’s temper flared up. “You black bastard — ” he muttered before Commander Winters jumped between them. Winters needed some time to think. Todd’s questions were after all. still unanswered. Even if there were good answers, it was not difficult to understand how someone could have come to the conclusion, based on the photographs, that there might be a conspiracy involved.

In addition, there was the issue of defending the actions of his junior officers and the investigating team. If I let these three go now, thought Winters, then we are essentially admitting that we made an error in the first place . . . Ramirez was gesturing at the commander. He nodded outside with his head. Winters did not understand at first, but Ramirez repeated the motion.

“Excuse us a second,” Winters said. The two officers walked out on the porch above the steps, leaving Todd with Nick and Carol and Troy. “What is it, Lieutenant?” Winters asked

“Commander, sir,” Ramirez answered, “my career is the Navy. If we release these three now, after no formal questioning — ”

“I couldn’t agree more,” Winters interrupted abruptly. “I wish that none of this today had happened. But it did. Now we must finish it up properly and thoroughly or we have no defense for what we did.” He thought for a minute. “How long would it take you to get the video and sound equipment set up for a formal interrogation?”

“About thirty minutes,” Ramirez replied. “Maybe forty-five at the most.”

“Let’s do it. While you’re getting ready, I’ll prepare the list of questions.”

Shit, said Winters to himself as he watched Ramirez walk briskly toward his office on the other side of the base. I am indeed going to be here all night. He thought of his missed chance with Tiffani . I’d better call her and explain while I’m drafting these questions. He felt a sudden burst of anger toward Lieutenant Todd. As for you, he thought, if we come out of this

unscathed, I will personally see to it that you are transferred to Lower Slobbovia.

It was after eleven o'clock. Lieutenant Todd stood near the front door. He was holding a billy club in his hand. Once before in the evening, just after Nick and Troy had reached the Pelican Resort parking lot, Todd had used the club on Nick's back to coerce him into the car. Nick could still feel the welt.

"How long is all this going to take?" Troy asked. He was standing near the desk. "Can't we go home now and get some sleep and come back on Monday morning . . ."

"You heard what the man said," Todd replied. He was definitely gloating. "They've gone off to prepare for a formal interrogation. You should be using this time to get your story straight." Todd pounded his palm with the billy club.

Troy turned to his companions. "All right, team," he said with a wink. "I move we blow this joint. Let's overpower this geek and blast out of here."

"Just try it, you shits," Todd rejoined. He smacked one of the empty folding chairs with his club for emphasis. "I'd like nothing better than to report that you tried to escape."

Nick had not said much since Winters and Ramirez had left. He now looked across the room at Todd. "You know what annoys me the most about this, Lieutenant?" he said to his captor. "It's that people like you," he continued, without waiting for an answer, "end up in positions of power or authority all over the world. Look at you. You think that because you have us under your control, that makes you somebody. Let me tell you something. You aren't shit."

Todd did not try to hide his dislike for Nick. "At least I can find white men to be my friends," he replied sarcastically.

"I do declare," Troy chimed in swiftly. "I believe our associate Lieutenant Todd may be a bigot. We may be talking to a true life honky. Let's see if 'nigger' is his next — "

"Boys, boys," Carol interceded as Todd started to move toward Troy. "Enough is enough. "The room became quiet. Troy walked back over to his friends and sat down in his chair.

A minute later Troy leaned over to Nick and Carol. As he was whispering to them, he put the gold bracelet right next to his mouth. "You know, folks," he said, "if we don't get out of here soon, we may be here all night. I can well imagine the questions taking three or four hours. And that means the Navy will get to the dive site before us in the morning."

"But what can we do?" Carol asked. "It would be a miracle if they let us just walk out without any questions."

"A miracle, angel." said Troy with a grin, "is just what we need. A good old-fashioned miracle. Like the blue fairy."

"What are you shits whispering about over there?" The truculent Lieutenant Todd began to walk toward the bathroom at the west end of the long room. "Knock it off. And don't try anything. The outside door is locked and I have the key." He didn't close the bathroom door. The urinal was fortunately out of view to the right.

There was not much light in the back of the small bathroom. As Todd was finishing his piss, he became aware of a strange sensation all over his right side, as if a thousand very small needles were sticking in him. Puzzled, he turned toward the corner. What he saw there sent an incredible shock of terror racing through his system.

In the corner, partially hidden in the poor light, was what could only be described as a six-foot carrot. The thicker end of the creature was balanced on four webbed pads planted on the floor. There were no arms, but about five feet above the ground, just under a maze of blue spaghetti of unknown purpose on top of its "head," four vertical slits, each a foot long, were cut in what might

have been its face. Out of each of these slits something strange was hanging. Troy would later explain to Nick and Carol that these were sensors, that the carrot saw, heard, smelled, and tasted with these dangling extensions.

Lieutenant Todd did not wait to study the creature. He let out a whoop and backed quickly out of the bathroom. He did not stop to retract his penis or zip his fly. When the weird orange thing next appeared in the light at the door to the bathroom, The lieutenant was certain it was going to follow him. He stared at it, petrified and immobile, for half a second. Then, when it did indeed move toward him, Todd immediately turned around, unlocked the front door, and burst through it.

Unfortunately he forgot about the eight concrete steps. In his panic he tripped and fell. He smacked his head hard on the second step and tumbled down to the bottom. He lay unconscious on his back on the sidewalk in front of the building.

Carol had cowered against Nick when she had first seen the carrot. Then they had both glanced at Troy. He was smiling and humming to himself, “When you wish upon a star . . . makes no difference who you are.” He seemed so blase about everything that Nick and Carol even relaxed temporarily. However, after Lieutenant Todd disappeared out the front door and the carrot turned to face them, it was difficult to remain calm.

“Nuts,” said Troy with a big smile. “I was really hoping for the blue fairy. I thought she might make me rich, or maybe even white.”

“All right, Jefferson,” Nick said. His face looked as if he had just eaten a lemon. “Please explain what that thing in front of us is.”

Troy first walked slowly over to the corner of the room to pick up their backpacks. “This, Professor,” he replied as he then walked directly up to the carrot, “is what we might call a holographic projection.” He put his hand into and through the orange body. “Somewhere in the universe there is supposedly a real life creature like this, but they have only sent his image to help us escape.”

Even with Troy’s explanation Nick and Carol did not want to come any closer to the stationary carrot than was absolutely necessary. They moved with their backs against the walls until they reached the door. “Don’t worry,” Troy laughed. “It won’t hurt you.”

The sensor hanging out of the slit on the far right of the carrot’s head was totally incomprehensible. Carol could not take her eye off of it. It looked like a wad of gooey honeycomb stuck on the end of a majorette’s baton. “What does it do with that?” Carol asked, pointing as she preceded Troy out the door.

“I don’t know, angel,” Troy answered. “But it must be fun.”

Nick and Troy joined Carol on the platform at the top of the stairs They all saw Todd at about the same time. They were naturally surprised to find him lying at the bottom of the steps. His head was bleeding. “Should we help him?” Carol wondered out loud as Troy bounded down the stairs in front of her.

“No way,” Nick replied quickly.

Troy bent down beside Todd and carefully examined the unconscious lieutenant from head to toe. He slapped the big man lightly on the cheek. Lieutenant Todd did not move. Troy winked at his friends at the top of the stairs. “The professor was right, my man,” he said, breaking into a grin, “you really aren’t shit.”

“So I kissed her,” Carol said with a laugh.

“You did what?” asked Nick. They were in Troy’s old Ford LTD. driving toward the Hemingway marina. After leaving the base they had walked the mile and a half to Troy’s duplex to pick up his car. Carol was beside Troy in the

front seat and Nick was in the back next to the backpacks containing the gold and the information discs.

Carol turned around to Nick. “I kissed her.” She laughed again as Nick screwed up his face in disgust. “What was I supposed to do? The woman is stronger than most men. She had me pinned on the floor. There was something just a little suggestive about the way she was holding me . . .”

“Whoooee, angel,” Troy slapped the dashboard with his left hand. “You are amazing. What did superkraut do next?”

“She released her grip on my wrists. Just for a second. I think she was deciding whether to kiss me back.”

“Yuch,” said Nick from the back seat. “I think I’m going to be sick.”

“So you smashed her up side of the head and then ran off?” asked Troy. Carol nodded. Troy laughed heartily and then became more serious. “Be careful if you ever see her again, angel. Greta does not like to lose.”

“But you’re wrong about her in one respect, Carol,” Nick remarked. “Greta’s not into women at all. She likes sex with men too much.”

Carol found Nick’s comment smug and even irritating. She spoke across the front seat to Troy. “Why is it, Troy, that men naturally assume that any woman who has sexual relations with men could not possibly be interested in having sex with another woman? Is this another example of their fundamental belief in their own innate superiority?” She didn’t wait for an answer. Carol turned around again to talk to Nick. “And in case you’re wondering, the answer is no, I’m not a lesbian. I am relentlessly heterosexual, as much because of my San Fernando Valley middle class background as anything. But I will admit that sometimes I grow extremely tired of men and what I call their baboon demonstrations of macho.”

“Hey,” Nick replied, “I didn’t mean to start an argument. I was just suggesting — ”

“Okay, okay,” Carol interrupted, loosening up a bit, “no harm done. I guess I am a little quick on the trigger.” She was quiet for a few seconds. “By the way, Nick,” she remarked then, “there’s one part of this that I still don’t understand completely. Why did Captain Homer go to such great lengths to hide the rest of the treasure all this time? Why didn’t he just sell it off as soon as he could?”

“Lots of reasons,” Nick replied. “Not the least of which was fear that he might somehow be discovered and indicted for the perjury he committed during our trial. But this way he also escapes the IRS, the value of the gold appreciates in time, and, most importantly, Greta has to hang around if she wants her whole share. He almost certainly converts some of it to cash from time to time, probably through a third party. But never enough to call attention to the transaction.”

“So you see, angel,” Troy said, “that’s why there’s no way he can call the police. Because he would have to admit everything. I bet he’s really pissed off.”

Troy pulled into a left-hand turn lane and waited for the signal to change. A car pulled up beside them on the right, next to Carol, and she just happened to look idly in that direction. It was a Mercedes.

Later on Carol would recall that time seemed to dilate for her. Each second of the next minute was recorded in her memory in super slow motion, as if it were covering a much longer period of time. Greta was driving Captain Homer’s car and was staring at Carol. Homer was sitting beside her, waving his fists, shouting something that Carol couldn’t hear through her closed window. Carol focused on Greta’s amazing eyes. Never had she seen such hatred. For just an instant Carol looked away to alert Troy and Nick. When she turned back she saw that Greta had a pistol pointed directly at her.

Three things happened almost simultaneously. Carol ducked, Troy pulled into the intersection against the red light, barely missing a speeding car, and

Greta fired the gun. The bullet ripped through Carol's window and crashed into Troy's door, somehow miraculously missing them both. Carol sat cringing under the dashboard in the front seat. She fought against panic and tried to catch her breath.

The chase was on. It was after eleven-thirty on a Saturday night in Key West and the traffic in the residential area was light. Troy's Ford was no match for the Mercedes. Twice more Greta maneuvered into position and the Ford was sprayed with bullets. Windows were broken and pitted but none of the occupants of the car was injured.

Nick was lying on the floor in the back seat. "Get down-town if you can," he shouted at Troy. "Maybe we can lose them in the traffic."

Troy was hunkered down behind the steering wheel as far as he could go. He could barely see the roadway in front of them. He was driving like a lunatic, swerving across the four-lane street into oncoming traffic, honking frantically, and making it impossible for Greta to predict his next move. "Where are the cops when you really need them?" he said out loud. "We have maniacs firing guns at us in the middle of Key West and there are no men of blue anywhere in sight."

After Nick's suggestion Troy suddenly spun around in the middle of the street and started heading in the opposite direction. Greta was not prepared. She hit the brakes on the Mercedes, went into a skid, caromed off a parked car, and then resumed the chase.

There were now no cars on the street in front of them and the Mercedes was closing the gap. "Uh oh," said Troy, fearing another attack. He violently pulled the steering wheel to the left, shot through an alley, into a parking lot, and back onto a narrow street. A few moments later he made a quick turn into a driveway. The car became flooded with light and Troy jammed on the brakes. "Everybody out," he hollered. While Nick and Carol were trying to determine what the hell was happening, Troy was giving his car keys to a tall figure dressed in a red uniform.

"We're just having drinks," he said. They heard the screech of the brakes on the Mercedes. "And those people behind us," Troy said in a loud voice to the half dozen onlookers, including two parking attendants, who were standing nearby, "have guns and are trying to kill us."

It was too late for Greta and Homer to escape. Troy had driven into the parking entrance of the Miyako Gardens Hotel and already another car had come into the circular drive behind the Mercedes. Greta threw the car in reverse, smashed against the grill and bumper of the Jaguar behind her, and then tried to make a run for it by squeezing around Troy's Ford. Troy and the uniformed attendant dove for cover as Greta hit the open door of the Ford, lost control of the Mercedes, and eventually crashed into the parking kiosk in the middle of the driveway. As Nick and Carol stumbled out of the car, four hotel security men surrounded Greta and Homer.

Troy walked over to join his friends. "Anybody hurt?" Both Carol and Nick shook their heads. Troy broke into a grand smile. "I guess that ought to take care of those characters," he said.

Carol gave him a hug. "It was a brilliant idea to drive here," she said. "What made you think of it?"

"Birds," Troy answered.

"Birds?" Nick responded. "What the fuck are you talking about, Jefferson?"

"Well, Professor," said Troy, opening the door to the elegant hotel and following his colleagues inside into the open atrium, "when they were about to catch us that last time, I realized that they were probably going to kill us for stealing their gold. And I wondered if there really were birds in heaven. My mother always told me that there were."

“Troy,” Carol said with a smile, “you are so full of shit. Come to the point.”

“Exactly, angel,” he answered. “Look around you.” In the atrium of the Miyako Gardens was a magnificent aviary whose tiny, threaded wire rose four stories into the air under a bank of skylights. Hundreds of colored birds played among the vines and palm trees and brought the real sound and feel of the tropics to the lobby of the hotel.

“When I thought about birds,” Troy could no longer restrain a crazy laugh, “I realized we were in the vicinity of this hotel and the plan sort of jumped into my mind.”

The three of them stood together and gazed up at the aviary. Carol was in the middle. She reached out her hands to both men.

REPATRIATION

BENEATH the emerald-green ocean the spacecraft rests quietly. Odd fishlike creatures swim by, observe the visitor from the heavens, and then continue on their journey. The final checkout before deployment is underway. When the checkout is completed, a door near the bottom of the craft opens and a gold metallic sphere with a diameter of about five inches appears. The sphere is tied down on top of a long, narrow platform. The treads underneath the platform propel it down a small ramp and then across the sandy ocean floor.

The flatbodied vehicle and its cargo disappear in the distance. After a long wait the strange moving platform returns to the spaceship without the golden sphere. The ramp slides back into the vehicle, the door closes, and the spacecraft is prepared for launch. Soon thereafter the great ship eases forward in the water, rising until it is just beneath the surface of the emerald ocean. It then reconfigures itself, adds wings, steerable flaps, and other control devices, and breaks the water looking temporarily like an airplane. Its ascent into the blue sky filled with light from the twin suns is rapid and breathtaking. Orbital velocity is reached in almost no time. Once in orbit above the atmosphere the aerodynamic surfaces are retracted and the spaceship makes one final voyage around the planet Canthor. When it reaches the proper true anomaly of its orbit, the craft accelerates quickly and hurtles again toward the cold and dark of interstellar space. The third delivery has been completed; nine more remain on its sixty-millicycle mission.

Three millicycles pass. The next target planet is only six systems away, another oceanic planet orbiting around a solitary yellow sun of unusual stability. The fourth cradle will be deposited there, on the third body away from the star, a planet whose period of motion about its central sun is so short that it makes fourteen revolutions in one millicycle.

Before reaching the target, the spaceship makes a detour. It dives deep into the hydrogen-rich atmosphere of the largest planet in the new system, thereby accomplishing two goals. Its velocity with respect to the central star is significantly slowed through conversion of kinetic energy to dissipated heat, and its reservoir of raw elements and primitive chemical compounds, from which the onboard manufacturing equipment creates all the backup and replacement parts, is partially replenished. After exiting from the dive into the thick atmosphere. the interstellar voyager covers the final distance to its target in a leisurely six hundred nanocycles.

During the approach, the automatic software in the central computer goes through a well-tested sequence designed to discover whether any of the conditions on the target planet have changed since the last complete set of systematic observations three cycles ago since the contents of each cradle have been uniquely designed, based upon the environment of the specific planet where the zygotes must grow and flourish, any major change in that environment could

drastically reduce the probability of survival for the repatriated species. Upon command from the computer, a battery of advanced remote sensing instruments is deployed to confirm the original design specifications for the planet.

But the instruments do not, as planned, validate the set of design assumptions. The environment has changed. Not markedly, not as if it had been reworked on a massive scale by an advanced intelligence for some specific purpose. The initial data strongly suggests instead that during the last cycle or two some indigenous intelligence has emerged that has had a nontrivial impact on both the planet's surface and its atmosphere.

As the remote sensing instruments continue their survey of the target planet, something even more unusual is discovered. There are artificial satellites, thousands of them, in orbit around the body. A spacefaring species now makes this planet its home. An alarm is triggered in the central computer of the spaceship. The zygotes and the cradle system destined for this planet were not designed to deal with any other advanced species.

However, the brilliant engineers of the Colony had anticipated that at least one of the dozen target planets might have changed significantly during the three cycles since the last regular observations. A contingency protocol for handling new situations has been programmed into the approach sequence. Essentially, this protocol calls for careful analysis of the new conditions on the planet, assessment of the impact of those conditions on the key probability of survival parameters, and then, assuming that the impact assessment is not unsatisfactory, transfer, where possible, of new information into the electronic infrastructure responsible for the education of the repatriated species after cradle deployment.

One of the special subroutines in the contingency protocol handles the surprise emergence of a new spacefaring species. The first action in the sequence is the examination of one of the orbiting satellites to assess its technological sophistication. With great care the interstellar spaceship eases into a rendezvous position with one of the artificial satellites that remain mostly stationary above a single region on the rotating planet below. Using superfast burst algorithms stored in the communications macro, the spacecraft searches for and establishes the command and telemetry frequencies of its neighbor. But attempts to actually command the satellite fail, suggesting an elaborate protective code embedded in the receivers and/or a complicated redundant command procedure.

Without being able to command the satellite and thus assess its capabilities, the visiting spaceship cannot conclusively establish the technological stage of the new spacefaring species. The contingency protocol calls, in this situation, for trying to "capture" the satellite to perform in situ analysis, provided there is no obvious danger from devices onboard the satellite itself. This particular branch in the software logic for the spaceship was the subject of intense debate by the oversight board of the Committee of Engineers back during the design process several cycles earlier. Many of the more experienced engineers thought that it was risky to include such a logic loop, primarily because of the possibility that a paranoid emerging culture might arm their satellites with destructive devices that could not be easily recognized and disarmed.

However, it was argued, on the basis of historical evidence from throughout the galaxy, that since most incipient civilizations abolish warfare and aggression before they become spacefaring, absence of a clearly identifiable destruct or protective device was sufficient additional evidence to allow the careful capturing and dismantling of a satellite. And everyone agreed that the detailed information about the technological status of the new species that would result from such "reverse engineering" would be extremely valuable in completing the assessment of the risk to the repatriated species.

Great remote manipulator arms extend from the spacecraft, seize the surveillance satellite, and pull it into a large room with vaulted ceilings. An army of small electronic robots attacks it at once, scurrying all over its surface with probes and attachments. Trillions of bits of data about the satellite are fed into the primary data storage device in the spaceship computer. The new spacefarers are not very advanced technically. In fact, the computer algorithm concludes, it is very surprising that they have even mastered launching and maintaining so many satellites.

An explosion starts to rip through the room. An astonishing sequence of events takes place almost instantaneously after the explosion, as the spaceship deploys its protective resources to stop the spread of the fireball and mitigate the damage caused by the small nuclear device that has vaporized its host satellite. The explosion is quickly contained by unknown techniques, but not until considerable destruction has been caused onboard the interstellar craft.

An elaborate self-test occupies the great spaceship after the explosion. Detailed computer analysis of the damage indicates that the probability of successfully deploying the cradles at the additional eight planets would be measurably increased if the mission were temporarily interrupted to allow some repair processes to take place. A safe haven to conduct the repair operations, in a known environment with very few variations is the concomitant requirement. The master computer decides, based on the system and subsystem constraints that must he applied during the repairs, that the shallow ocean floor on this target planet is a perfect place for such a hiatus in the mission plan.

The spaceship descends into the atmosphere, again reconfiguring itself to expose a set of aerodynamic control surfaces. During its rapid descent, the flight path is crossed by a bullet-shaped vehicle that has just been released from a high altitude airplane. The spaceship approaches and then flies alongside the missile. The missile telemetry is intercepted by the spaceship and correlated with the types of downlink data extracted from the satellite earlier. The spaceship computer uses its enormous processing capability and cross-correlation algorithms to try to break the command code of the tiny missile. Eventually it is successful and the visitor is able to interact with the guided projectile.

The spaceship commands the missile to read out its guidance subroutines. Performing quadrillions of computations per second, the intelligent computer at the heart of the interstellar craft deduces the targeting strategy for the missile. A target image that would result in the missile landing in the ocean, close to the chosen location for the space vehicle, is commanded into the missile’s guidance algorithm The spacecraft and missile plunge in tandem into the Gulf of Mexico.

The two vehicles come to rest about two miles apart on the ocean floor. Within the carefully coded fault protection software of the great spaceship, which took over operation of the craft immediately after the explosion of the satellite, four separate activities are being conducted in parallel. One of the processors is sorting through the data archives associated with this particular planet to determine what possible indigenous species could have gone through an evolutionary burst and become spacefaring with such rapidity. Coupled with this first set of computations is an evaluation of the impact of such a local advanced intelligence on the survivability of the repatriated zygotes. Among the questions addressed by the evaluation is what active steps can be taken by the spaceship now to increase the likelihood of successful embryo germination and development.

A third processor in the central computer performs a thorough, detailed analysis of the spacecraft state, including careful assessments of repair techniques and materials needed to fix each and every damaged component. The fourth major parallel subroutine directs the effort of the small flat robots

that go out into the ocean, first to verify that the nearby missile is harmless and can be safely brought back to the ship, and second to catalogue all the flora and fauna in the neighborhood in case any kind of camouflage becomes necessary.

The carpets bring the missile to the spaceship for additional analysis. No major new insights are gleaned from this study. The engineering similarities between the missile and the earlier artificial satellite are simply catalogued in the data archives. The concurrent spaceship damage assessment concludes that all the raw materials and tools necessary for the repairs are available except for the proper quantities of lead and gold both of which are difficult and time-consuming to make in the transmuter. If somehow enough additional lead and gold can be found, then the spaceship can be ready to leave this planet in three local days; if the spaceship has to make the lead and gold by itself, including leaching the elements in trace amounts from the ocean around it, then the total repair effort might take as long as thirty days.

The other two processors reach some equally interesting probabilistic conclusions. Mostly based upon the data taken during the endangered species roundup seven cycles earlier, two separate types of animals, one land-based and one water-based, are identified as the only possible candidates for the evolutionary burst that produced spacefarers in such a short time. Actually, according to the computer, if the land-based human beings survived their earlier nadir (around the time when some specimens were removed by the zoo ships of the Colony) and did not become extinct, they had by far the better chance of becoming the space voyager, especially in view of the results of the experiments conducted on them at the Zoo Complex. But if, indeed, the descendants of those bipedal, upright, aggressive creatures have become spacefarers, the processor warns, then the chances for survival to maturity by the zygotes in the cradle are extremely low. Unless somehow significant design changes in the cradle can be made on the spot or the development of the repatriates can be kept a secret from the humans for as long as a millicycle.

More worrisome for the extraterrestrial spaceship from the point of view of the overall mission is the tentative conclusion that it may well be discovered by the intelligent and potentially hostile inhabitants of the target planet in a comparatively short period of time. If discovered and seriously threatened, the spaceship could depart from the planet quickly and search for another haven to make repairs; however, traveling in the space environment in its current damaged state would be very risky. Another option would be for the spacecraft to send its own robots to the mines on this planet to extract the lead and gold that would virtually guarantee safe arrival at the next target, where the heavy metals are plentiful.

In either case, premature discovery by uncooperative Earthlings would almost certainly doom the zygote cradle that would be left on the Earth, if it is known that the cradle system came from the alien spacecraft. Thus the first action that the spaceship takes is to check out, deploy, and then hide the Earth cradle away from the vehicle. The carpets locate a sequestered spot six or seven hundred yards away on the nearby ocean floor and the platforms move the gold metallic cradle into that place under a rock overhang.

To reduce the probability of being discovered, the spaceship changes its outer surface to match the ocean floor around it. After a complex set of analyses of its entire decision matrix, the central computer concludes that the maximum likelihood of success path for the overall mission involves trying to enlist either the whales or the human beings to supply the extra lead and gold, as well as the new information to be transmitted to the cradle. So the spacecraft implements those repairs that are straightforward, puts itself into a standby for launch mode, and begins the task of communicating with the Earthlings.

The data taken by the Zoo explorers seven cycles ago (about a hundred thousand Earth years) suggested that the whales and human beings, at that time, had approximately the same potential for intelligence. The whale language was richer and more complicated at the time of this earlier investigation. The Zoo explorers studied it briefly and recorded in the archives its fundamental tenets. based upon that old data, while at the same time trying to develop a scenario for communicating with the humans, the spaceship attempts to make contact with the whales. Because the whales have not substantially changed in the intervening time, the attempts are partially successful; the whales understand that they are being called, but they are mostly confused by the messages and unable to figure out how to respond.

Two small pods of whales do, however, decipher the message transmitted in the ocean by the alien ship and swim toward its source. The robots in the extraterrestrial spacecraft examine the whales carefully, even showing the captive missile to one of the pods to elicit recognition, and conclude absolutely that the whales cannot be the spacefarers. Therefore it is the human beings who have made the great evolutionary strides and must be contacted and somehow induced to provide the lead and the gold and the requisite information. Further attempts to communicate with the whales are abandoned.

Before the alien ship has determined the method it will use to contact humanity, chance provides it with an excellent opportunity. During the final interactions with the whales, three human beings are swimming in the neighborhood. By incredible luck, these three find the deployed cradle and take it to the land. As a cautionary move, the spaceship computer commands temporary changes inside the cradle to ensure its protection and to provide for more frequent status monitoring; however, there is no major concern yet. The humans do not recognize the connection between the cradle and the spacecraft. In addition, with the zygotes in their early stages of pullulation, the cradle has an extremely robust design. Having the cradle in the possession of humans at this time can also be viewed as an advantage for the superaliens; receivers in the cradle can be commanded to listen to the conversations and then telemeter to the mother spacecraft information that will permit learning the rudiments of the human language.

The logical processes in the extraterrestrial computers are strained to the limit to figure out a way to contact human beings for help without creating undue risk for both the Earth cradle and the rest of the mission. The computers are about to decide on a rapid strike at mines for the lead and gold when they realize, based on their partial understanding of the human language, that the three humans who found the cradle may be coming back into the vicinity. All of the spaceship processors are strapped together to design a scenario that will induce these humans to help them. The inside of the spaceship is even reconfigured from scratch for the arrival of the humans. For if the scenario is successful, there is a high probability that the spaceship can continue on its mission, having successfully deposited the millions of repatriated zygotes, but without having disrupted the main flow of life on Earth. This was the original goal of the mission.

SUNDAY

1

IT was after two o’clock in the morning by the time the Florida Queen left the marina and headed out into the Gulf of Mexico. Carol and Troy stood together against the railing while Nick steered the boat through the harbor. “Well, angel,” Troy said, “it has already been an unbelievable experience, hasn’t it? And I must admit that I myself am a little nervous about what we’re going to find out at the dive site this time.”

“I thought you knew what was going to happen, Troy,” Carol replied, pointing at his bracelet. “Don’t they tell you everything?”

“They tell me a lot. And I’m getting better at understanding their messages. But how do I know if they’re telling the truth?”

“We have had the same problem with you at times,” Nick interjected from under the canopy. The boat was almost out in the open ocean. The lights from Key West were receding behind them. “In the final analysis, particularly when nothing makes sense anyway, it comes down to a question of trust. If I were to ask myself logically why I am going out into the Gulf of Mexico in the middle of the night to take lead and gold and information to some extraterrestrials who stopped here on the Earth to make repairs — ”

Carol laughed and interrupted. “But there’s no logical way to discuss this entire series of events. Troy already pointed that out. We’re not operating on logic. And I don’t even think it’s a question of trust so much.” She paused and looked up at the stars. “It’s more like faith.”

Troy put his arm around Carol and smiled. “I agree with you, angel. After all, we don’t know shit. Only they know.”

Carol yawned. There was silence on the boat. Everyone was very tired. After the security men had surrounded Homer and Greta at the Miyako Gardens, the police had of course been called. They had arrived within ten minutes but it had seemed as if their questions were going to last forever. Carol, Nick, and Troy had each been required to file a separate written statement. Homer and Greta admitted nothing, despite the fact that the security men had taken two handguns from them and matching bullet fragments were found inside Troy’s car. Homer had phoned his lawyer and was expecting to be out on bail within four to six hours.

When the trio did finally reach the marina (they had to walk from the hotel because the police impounded Troy’s car as evidence) carrying the backpacks, Troy remembered that he had not yet connected the new navigation equipment. Maybe it was because Troy was tired or perhaps having his two friends watch him part of the time over his shoulder made him nervous; whatever the reason, Troy was very slow in installing and verifying the new navigation processor.

Meanwhile, Carol and Nick had been checking to ensure that there were three complete sets of diving apparatus onboard the boat. The diving gear the men had used earlier in the evening was still out at the base in the possession of the United States Navy. Nick thought he recalled putting enough extra equipment on the boat to handle the large party from Tampa that had originally chartered the Florida Queen for the weekend. He was correct, but one of the regulator systems did not function properly during the checkout and had to be exchanged for a spare.

During the walk from the hotel to the marina, Nick and Carol and Troy had come to the unanimous conclusion that they would all three keep the underwater rendezvous with the superalien spaceship. There was no other reasonable solution. The boat could certainly be safely anchored. And none of the three of them could bear to think of missing the climax to their adventure.

Nick entered the ocean coordinates of the dive site into the navigation processor and put the boat on autopilot. He saw Carol yawn again. It was infectious. As he opened his mouth for a long, relaxing yawn, Nick realized how exhausted he was. He walked around behind the canopy and found two light air mattresses in a jumbled pile of supplies. He started inflating one of them by blowing into a valve at the end.

Carol came around to the back of the boat when the first mattress was almost inflated. The light on top of the canopy gave her face a glow. She’s even beautiful when she’s tired, Nick thought. He motioned to the other mattress. Carol bent down to pick it up and started inflating it. And very capable. I’ve never met a woman who was so good at so many things.

Nick finished with his air mattress and laid it down on the bottom of the boat. Carol was tiring, so he helped her inflate the rest of her mattress. He grabbed some towels and wadded them up like pillows. “We all have to sleep some,” he said to her as an explanation. “Otherwise we’ll be punchy when we try to dive.”

Carol nodded and walked back to the edge of the canopy. “Is it all right with you if Nick and I take a short nap?” she said to Troy. He smiled his assent. “Wake one or both of us in an hour,” she continued, “if you want to use one of the air mattresses.” She turned around and started to leave. “Uh, Troy,” she asked, before she left the side of the canopy.

“Yes, angel?” he answered.

“Do you know where they came from?” She pointed at the sky. Not too many stars were visible because of the brightness of the gibbous moon. It was well past its zenith and already into its western descent.

Troy looked up at the heavens and thought for almost a minute. “No, angel,” he responded at length. “I think they’ve tried to tell me, maybe even twice, but I can’t understand what they’re saying. But I do know that they come from another star.”

Troy now walked over beside Carol and gave her a kiss on the cheek. “Sleep tight and don’t let the bedbugs bite,” he said. “And maybe you can ask them yourself after you wake up.”

Where do you come from? Carol was thinking. And why did you land here, in this place, at this time? She shaded her eyes from the glare of the moon and concentrated her attention on Sirius, the brightest true star in the sky. Do you have a home there, around another star? With mothers and fathers and brothers? Do you have love and oceans and mountains and music? And longing and loneliness and fear of death? For reasons she could not understand, tears found their way into Carol’s eyes. She dropped her gaze and walked back to the air mattresses. Nick was already stretched out on one of them. He was on his back and his eyes were closed. Carol lay down on the mattress beside him. She reached out and put her hand in his. He pulled her hand to his lips, kissed it softly, and dropped it on his chest.

Nick’s dream was confusing. He was in the main lobby of a huge open library with twenty floors of books. He could see the spiral staircases ascending to the stacks above him. “But you don’t understand,” he said to the clerk standing behind the long counter. “I must read all these books this weekend. Otherwise I won’t be ready for the test on Monday.”

“I’m sorry, sir,” the diffident clerk replied quietly after scanning Nick’s list a second time. “But all copies of these books are currently checked out.”

Nick started to panic. He looked up at the enormously high ceiling and the floors of shelved books above him. He saw Carol Dawson up on the third floor, leaning against the railing and reading a book. His panic subsided. She’ll know the material, he thought to himself in the dream. He raced over to the staircase and bounded up the two flights of curving stairs.

He was out of breath when he reached Carol. She was reading one of the books that had been on his list. “Oh, good,” he said between gasps, “I knew as soon as I saw you that there was no worry.”

She looked at him quizzically. Without warning she thrust her hand down into the top of his jeans and grabbed his penis. He responded immediately and leaned forward to kiss her. She shook her head and backed up. He pursued her, pushing her against the railing. She fought him. He pressed hard against her body and succeeded in kissing her. The railing gave way and they were falling, falling. He woke up before they hit the floor in the lobby of the library.

Nick shuddered himself awake. Carol was watching him intently. Her head was resting on her hands, propped up by her elbow. “Are you all right?” she asked as soon as he opened his eyes.

It took Nick a few seconds to acclimate after the vivid dream. His heart was still racing out of control. “I think so,” he said. Carol continued to stare at him. “Why are you looking at me like that?” he asked.

“Well,” she began, “I woke up because you were talking. I even thought I heard my name a couple of times. Maybe I imagined it. If you don’t mind my asking, do you often talk in your sleep?”

“I don’t know,” Nick answered. He laughed a little. “Nobody has ever mentioned it to me before.”

“Not even Monique?” Carol said. Her eyes did not leave Nick’s. She could tell that he was trying to decide what kind of answer to give to her question. You’re pushing again, a voice inside her said. Let the man do things at his own pace.

Nick looked away. “We did not sleep together that much,” he said softly. There was a long pause. “Besides,” he said, now turning back to Carol, “that was ten years ago. I was very young. And she was married to someone else.”

While they had been sleeping Troy had switched off the light on the top of the canopy. The only light on their faces now was the reflection from the moon. They continued to look at each other in silence. Nick had not said very much to Carol about Monique, but it had been more than he had ever told anyone else, including his parents. Carol knew how much of an effort it had been for him to answer her question honestly. She rolled over on her back again and extended her hand to Nick.

“So here we are, Mr. Williams. Two solitary voyagers on the sea of life. Both of us are now past thirty. Many of our friends and classmates have already settled down into that house in the suburbs with the two kids and a dog. Why not us? What’s different about us?”

The moon was accelerating its downward arc through the sky above them. As it descended, more stars could be seen on the opposite horizon. Nick thought he saw a shooting star. There would be no way to hide from feelings. Nick was jumping ahead of the conversation, imagining for the moment that he was going to be involved with Carol. She would not permit it. At least I would not have any doubts about where we stood.

“When I was over at her house on Friday morning,” Nick finally replied to her question, “Amanda Winchester told me that I’m looking for a fantasy woman, someone absolutely perfect. And that mere mortals always come up short in my estimation.” He propped his head up and looked at Carol. “But I think it’s something else. I think maybe I’m not willing to make a commitment because of fear of rejection.”

Did I really say that? wondered Nick, shocked at himself. Instantly he felt as if he never should have shared the thought. His defenses began to build and he braced himself for a flippant or insensitive reply.

But it did not come. Instead Carol was quiet and thoughtful. At length she spoke. “My protection is different from yours,” she said. “I always play it safe. I pick men I admire and respect, intellectual pals if you will, but for whom I do not have any passion. When I meet a man who sets off the banjos and bells, I run the other way.”

Because I’m afraid, she thought. Afraid that I might love him as much as I did my father. And I could not survive if I were abandoned like that again.

She felt Nick’s hand on her cheek. He was caressing her gently. She reached up, took his hand, and squeezed it. He pulled himself up on his side where he could see her better. She could tell that he wanted to kiss her. She squeezed his hand again. Slowly, tentatively, he dropped his mouth on hers. It was a tender, adoring kiss, without pressure or overt passion, a subtle, artful question that could have been either the beginning of a love affair or the sole

kiss exchanged between two people whose paths just happened to cross in life. Carol heard banjos and bells.

2

WINTERS stood on the deck by himself, smoking quietly. It was not a large boat, this converted trawler, but it was very fast. They had not left the dock until after four o'clock and they had almost caught up with their prey already. The commander rubbed his eyes and yawned. He was tired. He blew smoke out over the ocean. On the eastern horizon there was just a faint suggestion of dawn. To the west, in the direction of the moon, Winters thought he saw the dim light of another boat.

These young people must all be crazy, he thought to himself as he reflected back on the events of the evening. Why the hell did they leave? Did they push Todd down those stairs without his knowing it? It would have been so much easier if they had just stayed there until we returned.

He remembered the look on Lieutenant Ramirez' face when he had interrupted the telephone conversation that Winters had been having with his wife, Betty. "Excuse me. Commander," Ramirez had said. He had been out of breath. "You must come quickly Lieutenant Todd is injured and our prisoners have escaped."

He had told his wife that he had no idea when he would be home and then joined Ramirez for the short walk back to the administration annex. On the way Winters had been thinking about Tiffani, about the difficulty he had had in explaining to the seventeen-year-old why he could not just drop everything and meet her at the party. "But you can work any day or night, Vernon," she had said. "This is our only time to be together." She had already drunk too much champagne. Later in the conversation, when Winters had made it clear to her that he almost certainly would not make it to the party at all, and that he would probably ask Melvin and Marc to take her home, Tiffani had become petulant and angry. She had stopped calling him Vernon. "All right, Commander," she had said, "I guess I'll see you at the theater on Tuesday night."

The phone had clicked off and Winters had felt an ache tearing through his heart. Oh fuck, he had thought for a moment, I've blown it. He had imagined himself jumping in the car, forgetting Todd and Ramirez and the Panther missile, and driving over to the party to sweep Tiffani into his arms. But he had not done it. Despite his incredible longing, he was not able to pull himself away from his duty. If it was meant to be, he told himself consolingly, then those flames of passion will burn again. But even with his limited romantic experience Winters knew better. Timing is everything in a love affair. If momentum is lost at a critical moment, especially when the rhythm of the passion is heading for a climax, it will never be regained.

Ramirez had already called the doctor on the base and he had arrived at the annex just after the two officers. While they were standing there together, Ramirez had insisted to Winters that it must have been foul play, that Todd could not have fallen so hard unless he had either been pushed or thrown down the concrete steps. The lieutenant had begun to stir during the doctor's examination. "He has a bad concussion," the doctor had said after he first checked Todd's eyes. "He'll probably be all right but he'll have a ferocious headache in the morning. Meanwhile, we'll take him over to the infirmary and sew up that gash in his head."

To Winters it didn't make sense. While he was waiting patiently in an adjoining room for the doctors and nurses to finish the stitches in the lieutenant's head, Winters tried to figure out what possible motive Nick and Carol and Troy could have had for attacking Todd and then escaping. The Dawson woman is smart and successful. Why would she do it? He wondered if perhaps the trio might have been involved in some kind of big drug transaction. That would

at least explain all the gold. But Todd and Ramirez did not find any indication of drugs. So what the hell is happening?

Lieutenant Todd had been kept awake during the procedure in the emergency room. He had been given only a local anesthetic to reduce his pain. But he had not been very lucid in response to the doctor's simple questions. "That sometimes happens with a concussion," the medical officer had told Winters afterward. "He may not be very coherent for the next day or two."

Nevertheless, around two o'clock, immediately after Todd's head had been shaven, stitched, and bandaged, Commander Winters and Lieutenant Ramirez had decided to ask him about what had occurred at the annex. The commander could not accept Todd's answer, even though the lieutenant repeated it twice verbatim. Todd had insisted that a six-foot carrot with vertical slits in its face had hidden in the bathroom and had jumped him while he was trying to take a piss. He had escaped that first assault, but the giant carrot had then followed him into the main room at the annex.

"And just how did this thing — "

"Carrot," interrupted Todd.

"And how did this carrot attack you?" continued Winters. Jesus, he had thought, this man has cracked. One bump on he head and he has finally flipped.

"It's hard to describe exactly," Lieutenant Todd had answered slowly. "You see, it had four doodads hanging out of these vertical slits in its head. They were all mean looking — "

The doctor had come up and interrupted. "Gentlemen," he had said with a perfect bedside smile, "my patient desperately needs rest. Surely some of these questions can wait until tomorrow."

Commander Winters remembered an overpowering sense of bewilderment as he watched the gurney take Lieutenant Todd from the emergency operating room to the infirmary. As soon as Todd was out of earshot, the commander had turned to Lieutenant Ramirez. "And what do you make of all this, Lieutenant?"

"Commander, sir, I'm no medical expert . . ."

"I know that, Lieutenant. I don't want your medical opinion. I want to know what you think about the, uh, carrot business." Damn him, Winters had thought. Does he have so little imagination that he can't even react to Todd's story?

"Sir," Ramirez had replied, "the carrot business is outside my experience."

To say the least. Winters smiled to himself and flipped his cigarette into the water. He walked over to the little wheel-house and checked the navigator. They were only seven miles from the target boat and converging rapidly. He pulled back on the throttle and put the boat into neutral gear. Winters did not want to draw any closer to the Florida Queen until Ramirez and the other two seamen were awake and in position.

He estimated that it was still about forty minutes until sunrise. Winters laughed again about Ramirez's unwillingness to venture a comment on Todd's carrot story. But the young Latino is a good officer. His only mistake was following Todd. Winters remembered how quickly Ramirez had organized all the details of their current sortie, picking the high-tech converted trawler for speed and stealth, rousting the two bachelor seamen who worked for him in Intelligence, and establishing a special link between the base and the trawler so that the whereabouts of the Florida Queen would be known at all times.

"We must follow them. We really have no choice," Lieutenant Ramirez had said firmly to Winters after they had verified that Nick's boat had indeed left the Hemingway Marina just after two o'clock. "Otherwise there's no way we could ever justify our having taken them into custody in the first place."

Winters had reluctantly agreed and Ramirez had organized the chase. The commander had told the younger men to get some sleep while he formulated the plan. Which is simple. Okay, you guys, come with us and answer the questions

or we'll charge you under the sedition act of 1991. Now, after putting the boat in idle, Winters was ready to wake Ramirez and the other two men. He intended to apprehend Nick, Carol, and Troy as soon as it was daylight.

The wind around the boat changed direction and Winters stopped a minute to check the weather. He turned his face toward the moon. The air suddenly felt warmer, almost hot, and he was reminded of a night off the coast of Libya eight years earlier. The worst night of my life, he thought. For a few moments his resolve to carry out his plan wavered and he asked himself if he was about to make another mistake.

Then he heard a trumpet blast, followed maybe four seconds later by a similar but quieter sound. Winters looked around him in the placid ocean. He saw nothing. Now he heard a group of trumpets and their echo, both sounds distinctly coming from the west. The commander strained his eyes in the direction of the moon. Silhouetted against its face he saw what appeared to be a group of snakes dancing out of the water. He went inside the wheelhouse to fetch a pair of binoculars.

By the time the commander returned to the railing a magnificent symphony surrounded him. Where is this incredible music coming from? he asked at first, before he succumbed completely to its mesmerizing beauty. He stood powerless against the railing, listening intently. The music was rich, emotional, full of evocative longing. Winters was swept away. not only into his own past where his deepest memories were stored, but also onto another planet in another era where proud and dignified serpents with blue necks called to their loved ones during their short annual mating rite.

He was spellbound. Tears were already flooding into his eyes when he at last mechanically lifted the binoculars and focused on the strange, sinuous shapes underneath the moon. The ghostlike images were completely transparent; the moonlight went right through them. As Winters watched what was a thousand necks dancing above the water, cavorting back and forth in perfect rhythm, and as he heard the music build toward the concluding crescendo of the Canthorean mating symphony, his tired eyes blurred and he swore that what he saw across the water in front of him, calling to him with a song of longing and desire, was an image of Tiffani Thomas. His heart was devastated by the combination of the music and the sight of her. Winters was aware of an intense sense of loss unparalleled in his life.

Yes, he said to himself as Tiffani continued to beckon in the distance, I'm coming. I'm sorry Tiffani darling. Tomorrow I will come to see you. We will . . . He stopped his interior monologue to wipe his eyes. The music had now entered the final crescendo. signaling the actual mating dance of the pairs of Canthorean serpents. Winters looked through his binoculars again. The image of Tiffani was gone. He adjusted his glasses. Joanna Carr came into focus, smiled briefly, and disappeared. A moment later the little Arab girl from the Virginia beach seemed to dance just under the moon. She was happy and gay. She too was gone in an instant.

The music was all around him. Bursts of sound, powerful, full, expressing pleasure no longer anticipated but now being experienced. He looked through his binoculars one more time. The moon was setting. As it fell into the ocean the image created against its illuminated disc by the dancing serpents was unmistakable. Winters clearly saw the faces of his wife, Betty, and his son, Hap. They were smiling at him together with a deep and abiding affection. They remained there in his vision until the moon sank completely into the ocean.

3

CAROL struggled to adjust her diving equipment. "Do you need some help, angel?" Troy asked. He came over and stood beside her in the predawn dark. He was already fully prepared for the dive.

“I haven’t worn anything like this since my first set of scuba lessons,” she said, fidgeting uncomfortably with the old-fashioned gear.

Troy tightened the weight belt around her waist. “You’re scared, aren’t you, angel?” Carol didn’t answer right away. “Me too. My pulse rate must be twice normal.”

Carol’s equipment seemed to please her finally. “You know, Troy, even after the last three days my brain is having a hard time convincing the rest of me that all this is really happening. Imagine writing it down for someone to read. “As we were preparing to return to the alien spaceship . . .’ ”

“Hey, you guys, come here,” Nick called from the other side of the canopy. Carol and Troy walked around to the front of the boat. Nick was staring out across the ocean to the east. He handed a small pair of binoculars to Carol. “Do you see a light out there in the distance, just to the left of that island?”

Carol could barely make out the light. “Uh huh,” she said to Nick. “But so what? Isn’t it reasonable that somewhere out in the ocean there would be another boat?”

“Of course,” Nick answered. “But that light hasn’t moved for fifteen minutes. It’s just sitting there. Why would a fishing boat, or any other kind of boat, be — ”

“Sh,” interrupted Troy. He put his fingers to his lips. “Listen,” he whispered, “I hear music.”

His companions stood quietly on the deck. Behind them the moon disappeared into the ocean. Above the gentle lapping of the waves all three of them could hear what sounded like the climax of a symphony, played by a full orchestra. They listened for thirty seconds. The music reached a peak, faded slightly, and then ceased abruptly.

“That was beautiful,” Carol remarked.

“And weird,” Nick said, walking over beside her. “Where the hell was it coming from? Is someone out there testing a new stereo system? My God, if the sound travels five or ten miles, it must be deafening up close.”

Troy was standing off to the side by himself. He was concentrating on something. Suddenly he turned to his companions. “I know this sounds crazy,” he said to Nick and Carol, “but I think the music was a signal for us to dive. Or perhaps a warning.”

“Great,” said Carol. “That’s what we need to reassure us. A warning of some kind. As if we’re not nervous enough.”

Nick put his arm around her. “Hey, lady,” he said, “don’t wimp out on us now. After all those brave comments about a once in a lifetime experience . . .”

“Really, let’s go,” Troy said impatiently. He looked anxious and very serious. “I’m definitely getting the message that we should dive now.”

Troy’s solemnity changed the mood of the trio. The three of them worked together in silence to secure the two buoyancy bags containing the lead, the gold, and the information discs. The eastern sky continued to brighten. It was only about fifteen minutes until sunrise.

While they were working, Carol noticed that Nick seemed a little distracted. Right before they left the boat she walked up beside him. “Are you all right?” she said quietly.

“Yes,” he answered. “I’m just trying to figure out if I’ve completely lost my mind. For eight years I have been thinking about what I would do if I ever had my full share of the treasure. Now I’m about to give it all away to some extra-terrestrials from God knows where.” He looked at her. “There’s enough gold here to last three people a long time.”

“I know,” she said, giving him a little hug. “I must admit that I’ve thought about it too. But in reality, part belongs to Amanda Winchester, part to Jake Lewis, most of it to the IRS . . .” She grinned. “And it’s only

money. That's nothing when you compare it to being the only humans to interact with visitors from another planet."

"I hope you're right," he said. "I hope I don't wake up tomorrow and feel as if I've made a terrible mistake. This entire episode has been so bizarre that I suspect my normal faculties aren't working properly. We don't even know for sure if these aliens are friendly . . ."

Carol pulled her diving mask over her face. "We'll never have all the answers," she said. She took his hand. "Let's go, Nick."

Troy was first into the water. Nick and Carol followed. It had been agreed before the dive that Carol would take the searchlight and lead the group. She was the most mobile of the threesome because each of the men was dragging a buoyancy bag. The trio had been concerned that they might have difficulty finding the ship and had discussed an elaborate set of contingency plans for locating it. They needn't have worried. Thirty feet under the Florida Queen, in virtually the exact place where the fissure had been on Thursday, there was a light in the water. Carol pointed at it and the two men swam up behind her. As they drew closer, they saw that the light was coming from a rectangular area about ten feet high and twenty feet wide. They could not see anything except what looked like some kind of material or fabric with a soft light behind it.

Carol hesitated. Troy swam right on by her, into the lighted area, his buoyancy bag trailing behind him. Everything disappeared. Nick and Carol waited. Carol felt herself tightening up. Come on now, Dawson, she thought, it's your turn. You've been here before. She took a deep breath and swam into the material. She felt something like plastic touch her face and then she was in a covered tunnel. A swift current was pulling her to the right. She went down a small water slide and was deposited in a shallow pool at the bottom. She clambered out of the pool and began removing her diving equipment.

Troy was standing on the floor about ten feet beyond the end of the pool. Next to him a warden had already taken the buoyancy bag, opened it, and adroitly separated the gold bars and the lead weights from the information discs. As Carol's eyes adjusted to the dim light around her, she saw that the warden was now loading the gold on a small platform sitting on top of tank treads about a foot above the floor. Immediately thereafter, the warden placed the information discs and the lead weights on two other platforms. A carpet that had been lying inconspicuously over against the wall on the left then rose up, apparently activated the treads under the platforms, and directed them toward a nearby hallway leading out of the room.

Carol pulled off her mask and finished removing her diving gear. She was in a medium-sized room somewhat like the ones she and Troy had encountered at the beginning of her last dive. The curved wall partitions were colored black and white. There was a small window to the ocean next to the splash pool on her left. The ceilings were low and tight, only a couple of feet above her head, giving her a feeling of claustrophobia. So here I am again, she thought, Back in Wonderland. This time I will take plenty of pictures. She photographed the procession of the carpet and three platforms just as it disappeared from the room. She then changed lenses and took a dozen quick close-up pictures of the warden standing next to Troy. It had the same amoebalike central body as the one she had confronted the day before, but there were only five implements sticking out of its upper half. The warden had probably been customized for its particular job of taking the objects from the trio.

Troy walked over beside her. "Where's Nick?" he asked. My God, Carol thought as she turned around and looked back at the slide and splash pool. I almost forgot. She chastised herself for not having waited for Nick. After all, he's never been down here . . .

Nick's big body careened out of control against the sides of the slide and he hurtled into the splash pool. The heavy buoyancy bag came down behind him and hit him hard, just above the kidneys. He stumbled to his feet, fell down in

the pool, and then stood up again. In his diving apparatus with the thin plastic material from the bag tied around his wrist, it was he who looked like the visitor from outer space.

Carol and Troy were laughing as Nick climbed out of the splash pool. “All right. Professor!” exclaimed Troy. He reached forward to give him a hand. “Good show. It’s a shame we don’t have that entry on tape.”

Nick removed his mouthpiece. He was out of breath. “Thanks a lot for waiting, team,” he stammered. He looked around him. “What is this place, anyway?”

The warden meanwhile had approached him from the side and was already tugging at the bag with one of its appendages. “Just a minute, weirdo,” Nick said, suppressing his fright. “Let me get my bearings first.”

The warden didn’t stop. A knifelike appendage cut the bag below where it was attached to Nick’s wrist. Next the warden took the entire bag, including its lead and gold contents, and somehow pushed it through its own semipermeable outer skin. The bag could be seen intact, adjacent to the rectangular control boxes, as the warden turned and hurried across the floor. It went through the same exit that the carpet and platforms had used earlier.

“You’re welcome,” Nick managed to say as he watched the strange creature disappear with the loot. He finished taking off his diving gear and walked over to Troy. “Okay, Jefferson, you’re the main man here. What do we do now?”

“Well, Professor,” he answered, “as far as I can tell, our job is finished. If you guys want, we can suit up again and jump through that window wall over there. We’d be back in the boat in less than five minutes. If I’ve read the messages right, these alien dudes will be ready to leave very shortly.”

“You mean that’s it? We’re done?” Carol asked. Troy nodded. “This is the most overrated experience since my first sexual encounter,” Carol commented.

Nick was walking across the room, moving directly away from the splash pool and his two friends. “Where are you going?” Troy asked.

“I paid a hefty admission price,” Nick replied. “I’m at least entitled to a tour.” Carol and Troy followed him. They crossed the empty room and walked through an exit between two wall partitions on the opposite side. They entered a short, dark, covered corridor. They could see light at the other end. They emerged into another room, this one circular and significantly larger. It had the high cathedral ceilings that Carol had liked so much on her last visit.

This room was not empty. Sitting in its middle facing them was a gigantic, enclosed, translucent cylinder, about twenty-five feet high altogether and ten feet in diameter at its base. A horde of orange pipes and purple cable sheaths attached the cylinder to a group of machines built into the wall behind it. There was a light green liquid filling the inside of the cylinder and eight gold metallic objects floating at different heights in the liquid. The objects were many different shapes. One looked like a starfish, another like a box, a third like a derby hat; the only thing the objects had in common was their gold metallic outer covering. Upon close inspection of the cylinder, thin membranes could be seen inside the liquid. These surfaces effectively partitioned the internal volume and gave each of the golden objects its own unique subvolume.

“All right, genius,” Nick said to Troy, after he stared at the cylinder for almost a full minute. “Explain what this is all about.” Carol was in a photographer’s paradise. She had nearly finished recording all hundred and twenty-eight pictures that could be stored on one minidisc. She had photographed the cylinder from all angles, including a close-up of each of the objects suspended in the liquid, and was now working on the machines behind it. She stopped taking pictures to listen to Troy’s reply.

“Well, Professor . . .” Troy started. His forehead was knitted as he tried to concentrate. “As far as I can make out from what they’ve been trying to tell me, this spaceship is on a mission to a dozen planets that are scattered in this part of the galaxy. On each planet the aliens leave one of those golden

things you see in the cylinder. They contain tiny embryos or seeds that have been genetically engineered for survival on that specific planet."

Carol walked over beside them. "So the ship goes from planet to planet, dropping off these packages containing seeds of some kind? Sort of a galactic Johnny Appleseed?"

"Sort of, angel, except that there are both animal and plant seeds inside the container. Plus advanced robots that nurture and educate the growing things until they reach maturity. Then the creatures can flourish on their own without help."

"All in that one little package?" Nick asked. He looked again at the fascinating objects floating in the liquid in the cylinder. He loved the golden color. All of a sudden he thought of the trident. He imagined thousands of tiny swarming embryos inside its outer golden surface and in his mind's eye he projected the growth of the swarm into the future. There was something fearsome about creatures genetically engineered to survive on the planet Earth. What if they are not friendly?

Nick's heart sped up as he realized what had been bothering him, partly subconsciously, since he started believing Troy's story about the aliens. Why did they stop on the Earth in the first place? What do they really want from us? His mind raced on. And if that trident contains beings destined for Earth that are extremely advanced, he thought, then it doesn't matter if they are friendly. We will be finished sooner or later anyway.

Carol and Troy were talking in general terms about the way an advanced civilization might use seeds to colonize other planets. Nick wasn't listening carefully. I can't tell Troy or even Carol. If the aliens know what I'm thinking they will stop me. I'd better do it soon.

"Troy," he heard Carol say as she began to take another set of pictures of the objects in the cylinder, "is it just co-incidence that the trident we found on Thursday looks so much like one of these seed packages?"

Nick did not wait for Troy to answer. "Excuse me," he interrupted in a loud voice. "I forgot something very important. I must go back to the boat. Stay here and wait for me. I'll be right back."

He burst out of the room, down the corridor, and across the room with the low ceiling and the window on the ocean. Good, he said to himself, nothing is going to stop me. Without even pausing to put on his diving gear, Nick took a huge breath and dove through the window. He was afraid that his lungs were going to explode before he reached the surface. But he made it. He climbed up the ladder and onto the boat.

Nick went immediately to the bottom drawer underneath the racks of electronic equipment. He reached in and grabbed the golden trident. He could feel that the axis rod had thickened considerably. It was now nearly twice as thick as it had been the first time that he held it. Carol was right. Damnit, why didn't I listen to her at the time? He pulled the object completely out of the drawer. The sun was just about to come up behind him. In the dawn light Nick could see that the trident had changed in several other ways. It was heavier. The individual tines on the fork end were much thicker and had almost grown together. In addition, there was an open hole into a soft, gooey interior on the north pole of the larger of the two spheres.

Nick examined it carefully. Suddenly he felt powerful arms wrap themselves around his chest and upper body, forcing him to drop the trident on the floor of the boat. "Now just hold steady," he heard a lightly accented voice say, "and turn around slowly. We won't hurt you if you cooperate."

Nick turned around. Commander Winters and a tall, fat seaman that Nick had never seen before were standing in front of him in wetsuits. Lieutenant Ramirez was still holding him from behind. Ramirez gradually released Nick and bent down to pick up the trident. He handed it to Winters. "Thank you,

Lieutenant," Winters said. "Where are your companions, Williams?" he then asked Nick. "Down there with my missile?"

Nick didn't say anything at first. Too much was happening too fast. He was having difficulty integrating Winters into his scenario for returning the trident to the spaceship. As soon as Nick had felt the changes in its outer surface, he had known for certain that the trident was one of the seed packages.

Winters was studying the trident. "And what's the significance of this thing?" he said. "You guys have taken enough photographs of it."

Nick was doing some calculations. If I am delayed here very long, then Carol and Troy will undoubtedly leave the ship. And the aliens will launch. He took a deep breath. My only chance is the truth.

"Commander Winters," Nick began, "please listen very carefully to what I'm about to say. It will sound fantastic, even preposterous, but it's all true. And if you will come with me, I can prove everything to you. The fate of the human race may well depend on what we do in the next five minutes." He paused to organize his ideas.

For some reason Winters thought about the ridiculous carrot story that Todd had told him. But the earnestness he was seeing in Nick's face persuaded him to continue to pay attention. "Go ahead, Williams," he said.

"Carol Dawson and Troy Jefferson are right now onboard a super-advanced extraterrestrial spaceship that is directly under this boat. The alien vehicle is traveling from planet to planet depositing packages of embryonic beings that are genetically designed to survive on a particular planet. That golden thing in your hand is, in a sense, a cradle for creatures that may later flourish on the Earth. I must return it to the aliens before they leave or our descendants may not survive."

Commander Winters looked at Nick as if he had lost his mind. The commander started to say something. "No," Nick interrupted. "Hear me out. The spacecraft also stopped here because it needed some repairs. At one time we thought it might have found your missile. That's partially how we got involved in the first place. We didn't know about the creatures in the cradle. So we were trying to help. One of the things the aliens needed for their repairs was gold. You see, they only had three days — "

"Jesus K. Christ!" Winters shouted at Nick. "Do you really expect me to believe this crap? This is the looniest, most farfetched story I have ever heard in my entire life. You're nuts. Cradles, aliens who need gold for repairs . . . I suppose next you'll be telling me that they are six feet tall and look like carrots — " "And have four vertical slits in their faces?" Nick added.

Winters glanced around. "You told him?" he said to Lieutenant Ramirez. Ramirez shook his head back and forth.

"No," Nick continued abruptly as the commander looked completely confused. "The carrot thing wasn't an alien, at least not one of the superaliens who made the ship. The carrot was a holographic projection . . ."

The perplexed Commander Winters waved his hands. " I'm not listening to any more of this nonsense, Williams. At least not here. What I want to know is what you and your friends know about the location of the missile. Now will you come with us over to our boat of your own free will, or do we have to tie you up?"

At that moment, six feet above them, a ten-legged, black, spiderlike creature with a body about four inches in diameter walked unnoticed to the edge of the canopy. It extended three antennae in their direction and then leaped off the side, landing on the back of Lieutenant Ramirez' neck. "Aieee," screamed the lieutenant during the pause in the conversation. He fell down on his knees behind Nick and grasped at the black thing that was trying to take a sample chunk out of his neck. For a second nobody moved. Then Nick grabbed a

large pair of pliers from the counter and thwacked the black thing once, twice, and even a third time before it released its grip on Ramirez' neck.

All four men watched it fall to the deck, scuttle rapidly over to the cradle that Commander Winters had put down so that he could assist Ramirez, shrink its size by a factor of ten, and disappear into the cradle through the soft gooey opening on the top of the sphere. Within seconds the goo hardened and all the external surfaces of the cradle were again rigid.

Winters was flabbergasted. Ramirez crossed himself. The seaman looked as if he were about to faint. "I swear to you that my story is true, Commander," Nick said calmly. "All you have to do is come down with me and see for yourself. I left my diving gear down there so that I could hurry up here to retrieve this thing. We can go together with my last working tank and share the air supply."

Winters' head was spinning. The ten-legged spider was the straw that broke the camel's back. He felt that he had now entered the Twilight Zone. I have never seen or heard anything even remotely like this before in my life, Winters thought. And only half an hour ago I had wild hallucinations with musical accompaniment. Maybe I am the one losing touch with reality. Lieutenant Ramirez was still on his knees. It looked as if he were praying. Or maybe this is finally my sign from God.

"All right, Williams," the commander was surprised to hear himself say. "I'll go with you. But my men will wait here on your boat for our return."

Nick picked up the trident and raced around the canopy to prepare the diving equipment.

It took Carol and Troy a few seconds to react to Nick's abrupt departure. "That was strange," Carol said finally. "What do you suppose he forgot?"

"I have no idea," Troy shrugged. "But I hope he hurries back. I don't think it's very long until launch. And I'm sure they will throw us out before then."

Carol thought for a moment and then turned back to look at the cylinder. "You know, Troy, those golden things are exactly like the trident on the outside. Did you say — "

"I didn't answer you before, angel," Troy interrupted. "But yes, you're right. It is the same material. I hadn't realized until we came down here today that what we picked up on that first dive was the seed package for Earth. They may have tried to tell me before; maybe I just didn't understand them."

Carol was fascinated. She walked over and put her face against the cylinder wall. It felt more like glass than plastic. "So maybe I was right when I thought it was heavier and thicker . . ." she said, as much to herself as to Troy. "And inside that trident are seeds for better plants and animals?" Troy nodded his head in response.

There was now some motion inside the cylinder. The thin membranes separating the subvolumes were growing what appeared to be guidewires that were wrapping themselves around the individual golden objects. Carol reloaded her camera with a new disc and ran around the outside of the cylinder, stopping in the best positions to photograph the process. Troy looked down at his bracelet. "There's no doubt about it, angel. These ETs are definitely preparing to launch. Maybe we should go."

'We'll wait as long as we can," Carol shouted from across the room. "These photographs will he priceless." They both could now hear weird noises behind the walls. The noises were not loud, but they were distracting because they were erratic and so totally alien. Troy paced nervously as he listened to the gamut of sounds. Carol walked over beside him. "Besides," she said, "Nick asked us to wait for him."

“That’s great,” Troy answered, “as long as they wait as well.” He seemed uncharacteristically nervous. “I don’t want to be onboard when these guys leave the Earth.”

“Hey there, Mr. Jefferson,” Carol said, you are supposed to he the calm one. Relax. You just said yourself that you think they’ll throw us out before they leave.” She paused and looked searchingly at Troy. “What do you know that I don’t?”

Troy turned away from her and started walking toward the exit. Carol ran after him and grabbed his arm. “What is it, Troy?” she said. ‘What’s wrong?”

“Look, angel,” he replied, not looking directly at her, “I just figured it out myself a minute ago. And I’m still not sure what it means. I hope I haven’t made a terrible — ”

“What are you talking about?” she interrupted him. “You’re not making any sense.”

“The Earth package,” he blurted out. “It has human seeds in it too. Along with the trees and insects and grasses and birds.”

Carol stood facing Troy, trying to understand what was bothering him so much. “When they came here a long long time ago,” he said, his face wrinkled with concern, “they took specimens of the different species and returned them to their home world. Where they were improved by genetic engineering and prepared for their eventual return to the Earth. Some of those specimens were human beings.”

Carol’s heart quickened as she realized what Troy was telling her. So that’s it, she said to herself. There are superhumans inside that package we’ve found. Not just better flowers and better bugs, but better people as well. But unlike Troy, Carol’s immediate reaction was not fear. She was overwhelmed by curiosity.

“Can I see them?” she asked excitedly. Troy didn’t understand. “The superhumans, or whatever you want to call them . . . ,” she continued, “can I see them?”

Troy shook his head. “They’re just tiny zygotes, angel. More than a billion would fit in your hand. You wouldn’t be able to see anything.”

Carol was not dissuaded. “ But these guys have such amazing technological ability. Maybe they can . . .” She stopped. “Wait a minute, Troy. Remember that carrot on the base? It was a holographic projection and must have come somehow out of the information base on this spacecraft.”

Carol walked away from Troy into the middle of the room. She raised her arms and looked up at the ceiling thirty feet above her. “Okay, you guys, whoever you are,” she invoked in a loud voice. “Now there’s something that I want. We risked our ass to get what you needed for your repairs. You can at least reciprocate. I want to see what we might look like someday . . .”

To their left, not too far from one of the large blocky machines connected to the cylinder, two of the wall partitions moved apart to form a hallway. They could see light at the other end. “Come on,” an exultant Carol called to Troy, who was again smiling and admiring her assertiveness, “let’s go see what our superaliens have created for us now.”

At the end of the short corridor, there was a softly lit square room about twenty feet on a side. Against the opposite wall, illuminated by a blue light that gave the entire tableau a surrealistic appearance, eight children were standing around a large, glowing model of the Earth. As Carol and Troy approached, they recognized that what they were seeing was not real, that it was simply a complex sequence of images projected into the air in front of them. But the diaphanous picture contained such rich detail that it was easy to forget it was just a projection.

The children were four or five years old. All were wearing only a thin white loincloth that covered their genitals. There were four girls and four boys. Two of them were black, two were Caucasian with blue eyes and blonde

hair, two were Oriental, and the final boy and girl, definitely twins, looked like a mixture of all humanity What Carol immediately noticed was their eyes. All eight children had large, piercing eyes of brilliant intensity that were focused on the glowing Earth in front of them.

"The continents of this planet," the little black boy was saying, "were once tied together in a single gigantic land mass that stretched from pole to pole. This was relatively recently, only about two hundred million years ago. Since that time the motion of the plates on which the individual land masses rest has completely changed the configuration of the surface. Here, for example, you can see the Indian sub continent tearing away from Antarctica a hundred million years ago and moving across the ocean toward an eventual collision with Asia. It was this collision and the subsequent plate interaction that lifted the Himalayas, the highest mountains on the planet, to their current height."

As the little boy was talking, the electronic model Earth in front of him demonstrated the continental changes that he was describing. "But what is the mechanism that causes these plates and land masses to move with respect to each other?" the tiny blonde-haired girl asked.

"Psst," Carol whispered in Troy's ear. "How come they are speaking English and know all this Earth geography?" Troy looked at her as if he were disappointed and made a circular motion with his hands. Of course, Carol said to herself, they've already processed the discs.

". . . then this activity results in material being thrust upward from the mantle below the Earth's crust. Eventually the continents are pushed apart. Any other questions?" The black boy was smiling. He pointed at the model in front of him. "Here's what will happen to the land masses in the next fifty million years or so. The Americas will continue to move to the West, away from Africa and Europe, making the South Atlantic a much larger ocean. The Persian Gulf will close altogether, Australia will drive north toward the equator and press against Asia, and both Baja California and the area around Los Angeles will split off from North America to drift northward in the Pacific Ocean. By fifty million years from now Los Angeles will start sliding into the Aleutian Islands."

All of the children watched the changing globe with complete attention. When the continents on the surface of the model stopped moving, the Oriental boy stepped slightly out from the group. "We have seen this continental drift phenomenon that Brian has been describing on half a dozen other planets, all of them bodies mostly covered by a liquid. Tomorrow Sherry will lead a more detailed discussion about the forces inside a planet that cause the sea floor to spread in the first place."

A projected image of a warden entered the scene from the left and removed both the Earth globe and several other unidentified props. The small boy waited patiently for the warden to complete his task and then continued, "Darla and David now want to share with us a project they have been working on for several days. They will play the music while Miranda and Justin perform the dance they choreographed."

The mixed twins turned eagerly to their classmates. The girl spoke out. "When we first learned about adult love and the changes that we all can expect after we pass puberty, David and I tried to envision what it would be like to find a new desire even stronger than those we already know. Our joint vision became a short musical composition and a dance. We call it 'The Dance of Love.' "

The two children sat down away from the group, almost at the side of the image, and began moving their fingers rapidly as if they were typing on the floor. A light synthesized melody, pleasant and spirited, filled the room. The blond boy and the Oriental girl began to dance in the center of the group. At first in the dance, the two were totally separate, unaware of each other, each

child completely absorbed in his own activities. The boy knelt down to pick a beautiful flower, its red and white coloring shimmering in the holographic projection. The girl bounced a large bright blue ball as she danced. After a while the little girl noticed the boy and approached him, somewhat tentatively, offering to share the ball. The boy played ball with her but ignored everything except the game.

This is magic, thought Carol as she watched the children's images moving with grace and deft precision in front of her. These children are wonderful. But they can't be real. They are too orderly, too self-contained. Where is the tension, the strife? But despite her questions she was profoundly moved by the scene she was witnessing. The children were acting in concert, as a group, flowing in harmony from activity to activity. Their body language was open and unafraid. No neuroses were blocking their learning process.

The dance continued. The music deepened as the boy began to pay attention to his partner and she began arranging her hair with his favorite flowers for their brief encounters. The body movements changed as well, the sprightly, exuberant bounces of the initial stages giving way to subtly suggestive motions designed to awaken and then tease the budding libido. The tiny dancers touched, moved away, and came back together in an embrace.

Carol was entranced. How would my life have been different, she wondered, if I had known all this at the age of five? She remembered her rich friend at soccer camp, Jessica from Laguna Beach, whom she had seen occasionally in subsequent years. Jessica was always ahead, always had to be first. She had had sex with boys before I even started my period. And look what happened to her. Three marriages, three divorces, just thirty years old.

Carol tried to stop her mind from drifting so that she could pay complete attention to the dance. Suddenly she remembered her camera. She had just taken her first pictures of the children when she heard a noise behind her. Nick was coming toward them through the corridor. And he was carrying the trident in his hand.

Nick started to say something but Troy hushed him by putting his finger against his own lips and pointing at the dance in progress. The tempo had now changed. The two mixed children had somehow put the music on automatic (it seemed to be repeating some of the early verses, but with additional instruments in a more complex pattern) and joined the blond boy and the Oriental girl in the dance. Carol's first impression before Nick spoke out loud was that the dance was now exploring friendships between the paired couple and other people.

"What's this all about?" Nick said. The moment he spoke the entire projected tableau vanished. All of the children, the dance, and the music disappeared in an instant. Carol was surprised to find that she was disappointed and even a little angry. "Now you've blown it," she said.

Nick looked at his companions' stern faces. "Jesus," he said, holding up the cradle, "such a greeting. I bust my butt to go retrieve this damn thing and you guys are pissed when I come back because I interrupt a movie of some kind."

"For your information, Mr. Williams," Carol replied, "what we were watching was no ordinary movie. In fact, those kids in that dance are the same species as the ones in your trident." Nick looked at her skeptically. "Tell him, Troy."

"She's right, Professor," Troy said. "We just figured it out while you were gone. That thing you're carrying is the seed package for Earth. Some of the zygotes in there are what Carol calls superhumans. Genetically engineered humans with more capability than you or me. Like the kids we just saw."

Nick lifted the cradle to eye level. "I had figured out myself that this thing was a seed package. But what's this shit about human seeds?" He glanced at Troy. "You're serious, aren't you?" Troy nodded his head. Troy nodded. All three of them stared intently at the object in front of them. Carol kept glancing back and forth from the trident to where the image of the superchildren

had been. “It still doesn’t seem possible,” Nick added, “but then nothing else has for the last — ”

“So what did you forget, Nick?” Carol interrupted. “And why did you bring that thing back?” There was no immediate response from Nick. “By the way,” she smiled, “you missed the show of a lifetime.”

“The trident was what I forgot,” Nick answered. “It occurred to me, while I was studying the gold objects in the cylinder, that our trident might be a seed package. And I was worried that it might be dangerous . . .”

The sudden sound of organ music flooding down the corridor from the large room behind them stopped their conversation. Nick and Carol looked at Troy. He put the bracelet up to his ear as if he were listening to it and cracked a large grin. “I think that’s the five-minute warning,” Troy said. “We’d better make our last touchdown and clear out of here.”

The trio turned and walked back down the corridor to the room with the cylinder. When they arrived. Carol and Troy were astonished to see a figure in a blue and white wetsuit on the opposite side of the room. He was kneeling reverently right next to the cylinder.

“Oh, yeah.” said Nick with a nervous laugh, “I forgot to tell you. Commander Winters came back with me . . .”

Commander Winters had felt quite comfortable in the water even though he had not been down on a dive in five years. Nick had gone freestyle, swimming right beside the commander and using the emergency mouthpiece connected to the air supply on Winters’ back. Despite his sense of urgency, Nick had remembered that Winters was basically a novice again and had not rushed the first part of the dive. But when Winters had refused several times to follow Nick up close to the light in the ocean, Nick had become exasperated.

Nick had then taken a final deep breath from the ancillary mouthpiece and grabbed Winters by the shoulders. With gestures, he had explained to the commander that he, Nick, was going to go through the plastic stuff or whatever it was in front of the light and that Winters could either follow him or not. The commander had reluctantly given Nick his hand. Nick turned around immediately and pulled Winters into and through the membrane that separated the alien spaceship from the ocean.

Winters had been completely terrified during his tumble on the water slide inside the vehicle. As a result he had lost his bearings and had had great difficulty standing up after he landed in the splash pool. Nick was already out of the pool and anxious to find his friends. “Look,” Nick had said, as soon as he could get the commander’s attention, “I’m going to leave you now for a few minutes.” He had pointed at the exit on the opposite of the room. “We’ll be in the big room with the high ceilings just on the other side of that wall.” Then he had left carrying the strange golden object from the boat.

Winters was left alone. He carefully pulled himself out on the side of the splash pool and methodically stacked his equipment alongside all the rest of the diving gear. He looked around the room, noting the curves in the black and white partitions. He too felt the closeness of the ceiling. Now according to Williams, the commander thought to himself, I’m in part of an alien spaceship that has temporarily stopped on Earth. So far, except for that clever one-way entrance that I did not have time to analyze, I see no evidence of extraterrestrial origin . . .

Comforted by his logic, he eased across the room toward the opposite wall and into the dark corridor. But his newfound sense of comfort was totally destroyed when he walked into the room dominated by the enormous cylinder with the golden objects floating in the light green liquid. He arched his back and stared at the vaulted, cathedral ceilings far above his head. He then approached the cylinder.

For Winters, the connection between the trident that Nick had been holding and the objects inside the cylinder was instantaneous. Those must be more seed packages, destined for other worlds. Winters thought, his crisp logic disappearing in a quick leap of faith. With six-root carrots and who knows what else to populate a few of the billions of worlds in our galaxy alone.

The commander walked around the cylinder as if he were in a dream. His mind continually replayed both what Nick had told him right before they descended and the amazing scene he had witnessed when the spiderlike creature had shrunk up and jumped into the golden object. So it's all true. All those things the scientists have been saying about the possibility of vast hordes of living creatures out there among the stars. He stopped for a moment, partially listening to the strange noises behind the walls. And we are only a few of God's many many children.

Organ music, similar in timbre to that which Carol had heard when she had finished playing "Silent Night," but with a different tune, began to sound in the distant reaches of the ceiling above him. It reminded Winters of church music. His reaction was instinctual . He knelt down in front of the cylinder and clasped his hands together in prayer.

The music swelled in the room. What Winters heard in his head was the introduction to the Doxology. the short hymn that he had heard every single Sunday for eighteen years in the Presbyterian church in Columbus, Indiana. In his mind's eye he was thirteen years old again and sitting next to Betty in his choir robes. He smiled at her and they stood up together.

Praise God from whom all blessings flow.

The choir sang the first phrase of the hymn and Winters' brain was bombarded by a montage of memories from his early teens and before, a suite of epiphanic images of his innocent and unknowing closeness with a parental God, one who was in the wall behind his bed or just over his rooftop or at most in the summer afternoon clouds above Columbus. Here was an eight-year-old boy praying that his father would not find out that it was he who had set fire to the vacant lot across from the Smith mansion. Another time, at ten, the little Vernon wept bitter tears as he held his dead cocker spaniel Runtie in his arms and begged the omniscient God to accept his dead dog's soul into heaven.

The night before the Easter pageant, the first time that Vernon had portrayed Him in His final hours, dragging the cross to Calvary, eleven-year-old Vernon had been unable to sleep. As the night was passing by the boy began to panic, began to fear that he would freeze up and forget his lines. But then he had known what to do. He had reached under his pillow and found the little New Testament that always stayed there, day and night. He had opened it to Matthew 28. "Go ye therefore," it had said, "baptizing all nations . . ."

That had been enough. Then Vernon had prayed for sleep. His friendly, fatherly God had sent the little boy an image of himself delivering a spellbinding performance in the pageant the next day. Comforted by that picture, he had fallen asleep.

Praise Him all creatures here below.

With the second phrase of the hymn resounding in his ears the venue for Winters' mental montage changed to Annapolis Maryland. He was a young man now, in the last two years of his university work at the Naval Academy. The pictures that flooded his brain were all taken at the same place, outside the beautiful little Protestant chapel in the middle of the campus. He was either walking in or walking out. He went in the snow, in the rain, and in the late summer heat. He would fulfill his pledge. He had made a bargain with God, a business deal as it were, you do your part and I'll do mine. It was no longer a one-sided relationship. Now, life had taught the serious young midshipman from Indiana that it was necessary to offer this God something in order to guarantee His compliance with the deal.

For two years Vernon went regularly to the chapel, twice a week at least. He did not really worship there; he corresponded with a worldly God, one that read the New York Times and the Wall Street Journal. They discussed things. Vernon reminded Him that he was steadfastly upholding his end of the deal and thanked Him for keeping His part of the bargain. But never once did they talk about Joanna Carr. She didn't matter. The whole affair was between Midshipman Vernon Winters and God.

Praise Him above ye heavenly host.

The commander had unconsciously bowed his head almost to the floor by the time he heard the third phrase of the hymn. In his heart he knew the next stops on this spiritual journey. He was off the coast of Libya first, praying those horrible words requesting death and destruction for Gaddafi's family. God had changed as Lieutenant Winters had matured. He was now an executive, a president of something larger than a nation, an admiral, a judge, somewhat remote, but still accessible in time of real need.

However, he had lost his all-forgiving nature. He had become stern and judgmental. Killing a small Arab girl wasn't like burning down the vacant lot across from the Smith mansion. Winters' God now held him personally accountable for all his actions. And there were some sins almost beyond forgiveness, some deeds so heinous that one might wait for weeks, months, or even years in the anterooms of His court before He would consent to hear your plea for mercy and expiation.

Again the commander remembered his desperate search for Him after that awful evening when he had sat on the couch beside his wife and watched the videotaped newsreels of the Libya bombing. She had been so proud of him. She had taped every segment of CBS news that had covered the North African engagement and then surprised him with a complete showing the day after he returned to Norfolk. It was only then that the full horror of what he had done had struck Winters. Struggling not to vomit as the camera had shown the gruesome result of those missiles that had been fired from his planes, Winters had stumbled out into the night air, alone, and wandered until daybreak.

He had been looking for Him. A dozen times in the next three years this rite would repeat itself and he would wander again, all night, alternately praying and walking, hoping for some sign that He had listened to the commander's prayers. The stars and moon above him on those nights had been magnificent. But they could not grant forgiveness, could not give surcease to his troubled soul.

Praise Father, Son, and Holy Ghost.

And so God became blackness, a void, for Commander Winters. On those rare occasions afterward when he would pray, there was no longer any mental image of God, no picture of Him at all in his mind. There was just blackness, darkness, emptiness. Until this moment. As he knelt there outside the cylinder, heard the final phrase of the Doxology, and prayed to God to forgive him his doubts, his longings for Tiffani Thomas, and his general lack of direction, there was an explosion of light in Winters mind's eye. God was speaking to him! God had at last given him a sign!

It was not the sign that Winters had been seeking, not evidence that He had finally forgiven the commander and accepted his penance, but something much much better. The explosion of light in Winter's mind was a star, a solar furnace forging helium out of hydrogen. As his mental camera backed away rapidly, Winters could see planets around that star and signs of intelligence on a few of the planets. There were other stars and other planets in the distance. Billions of stars in this galaxy alone and, after the mammoth voids between the galaxies, more huge collections of stars and planets and living creatures stretching incomprehensible distances in all directions.

Winters' body shook with joy and his eyes flooded with tears when he realized how completely God had answered his prayers. It would not have been

enough for Him to simply reveal to Winters that he was forgiven. No, this Lord of everything imaginable, whose domain embraced chemicals risen to consciousness on millions of worlds in a vast and uncountable universe, this God who was truly omnipotent and ubiquitous, had gone way beyond his prayers. He had shown Winters the unity in everything. He had not limited Himself just to the affairs of one individual on a small and insignificant blue planet orbiting an ordinary yellow sun in one of the spiral arms of the Milky Way Galaxy; he had also shown Winters how that species and its pool of intelligence and spirituality was connected to every part of every atom in His grand dominion.

As Nick walked across the room toward Commander Winters, the intermittent noises behind the walls increased in amplitude and frequency. Around on the far side of the cylinder, next to one of the larger support machines, a door opened and two carpets, moving inchworm style, came into the room. They were immediately followed by two wardens and four platforms on treads. The platforms were carrying stacks of building materials. Each of the wardens led two platforms to a corner of the room, where they started constructing secure anchor stanchions for the cylinder.

The two carpets confronted Nick in the center of the room. They stood up on end and leaned in the direction of the exit toward the ocean. “They’re telling us it’s time to go,” Carol said as she and Troy came up beside Nick.

“I understand that,” Nick replied. “But I’m not yet ready to leave.” He turned to Troy. “Does this game have an X key at all?” he asked. “I could use a time out.”

Troy laughed. “I don’t think so, Professor. And there’s no way we can save the game and try again.”

Nick looked as if he were in deep thought. The carpets continued to beckon. “Come on, Nick,” Carol grabbed him by the arm. “Let’s go before they get angry.”

Suddenly Nick advanced toward one of the carpets and extended the golden cradle. “Here,” he said, “take this and put it with the rest of them, up there, in the cylinder where it belongs.” The carpet recoiled and twisted its top from side to side. Then it pulled its two vertical sides together and pointed at Nick.

“I don’t need a bracelet to interpret that gesture,” Troy remarked. “The carpet is plainly telling you to take the trident back to your boat.”

Nick nodded his head and was quiet for a moment. “Is this the only one?” he asked Troy. Troy didn’t understand the question. “Is this the only seed package for Earth?”

“I think so,” Troy answered after a moment’s hesitation. He looked at Nick with a puzzled expression.

Meanwhile the activity level in the room had increased substantially. As Commander Winters ambled toward the trio in the middle of the hubbub, the wardens and platforms were actively building in the corners, moving equipment could be heard behind the walls, and the organ music was growing louder and slightly ominous. In addition, a giant sock or cover of some kind, lined with a soft, pliant material, had unfurled above them in the ceiling and was descending slowly over the cylinder. Commander Winters stared around the room with undisguised astonishment. Still serenely content in his heart from the beauty and intensity of his epiphany, he was not paying much attention to the conversation beside him.

“They must take this thing with them,” Nick was saying earnestly to Carol and Troy. “Don’t you see? It’s even more important now that I know there are human seedlings inside. Our children won’t have a chance.”

“But they were so beautiful, so smart,” Carol said. “You didn’t see them like we did. I can’t believe those children would ever hurt anybody or anything.”

They wouldn’t mean to destroy us,” Nick argued. “It would just happen.”

The carpets were starting to jump up and down. “I know, I know,” Nick said as he again extended the cradle toward them. “You want us to go. But first, please listen to me. We’ve helped you, now I’m asking that you help us. I’m afraid of what might be in this package, afraid that it might upset the delicate stability of our planet. Our progress as a species has been slow, in fits and starts, with almost as many backward steps as forward. Whatever is here could threaten our future development. Or maybe even halt it altogether.”

The activity in the room continued unabated. There was no noticeable reaction to Nick’s speech from the impatient carpets, who were now taking turns walking over to the exit in case the dumb humans still did not understand their message. Nick looked entreatingly at Carol. She returned his gaze and smiled. After a few seconds she came over and took his hand. Their eyes met for a brief moment as she started talking and Nick saw a new expression, something approaching admiration, in her glance.

“He’s right, you know,” Carol said in the direction of the pair of carpets. “You haven’t thought carefully enough about the outcome of this mission of yours. Sooner or later your special embryos and the humans already on this planet will interact and there will be a catastrophe. If the seed package is found early in the development of your superhumans, I am certain the Earthlings will feel compelled to destroy it. What possible other reaction could they have? The magnitude of the threat may not be fully known, but it is easy to recognize that creatures genetically engineered by superaliens could pose a gigantic problem for the native species of this planet.”

Troy was standing just behind Nick and Carol, listening attentively to what she was saying. Around him the preparations for launch continued. The wardens and platforms had finished constructing and installing the two pairs of stanchions that would be connected to the cylinder during launch to minimize vibrations. The golden cradles in the cylinder could no longer be seen; the cover had descended almost to the floor.

“. . . So unless you take this golden package back with you, perhaps to place it on another world which does not yet have intelligence, there will be unnecessary death. Either your seedlings will perish before maturity or the native humans like us will eventually be swallowed up, if not killed outright, by the more capable beings you have engineered. That hardly seems to be a fair reward for our effort on your behalf.”

Carol stopped to watch four strange cords extend themselves from the top and near the bottom of the cylinder, wriggle through the air, and end up attached to the stanchions in the corners of the room. The carpets were becoming increasingly agitated. The two wardens finished supervising their prelaunch procedures. They turned abruptly toward the four human beings and moved in their direction.

Carol tightened her hold on Nick’s hand. “Perhaps it’s true that our natural development is a slow and not altogether satisfactory process, “ she continued, fear creeping into her voice as the dreaded wardens quickly approached them, “and it’s certainly true that we humans here make mistakes, both as individuals and as groups . However, you can’t overlook the fact that this imperfect process produced us, and we had enough foresight or compassion or whatever you want to call it — ”

“Hold it,” shouted Troy. He seized the cradle from Nick’s hand and jumped directly into the path of one of the menacing wardens. He was only inches away from two whirling, threatening rods with cutting implements on the end. “Hold it,” he shouted again. Miraculously, all activity ceased. The carpets and wardens stood still, the noises in the wall stopped, even the organ music was silenced. “Of all of us,” Troy said in a loud voice, his head tilted back and aimed at the ceiling, “I have the most knowledge of what your mission is all

about. And the most to lose by recommending that you abandon this part of it. But I agree with my friends."

Troy removed his bracelet and then dramatically jammed both the bracelet and the cradle inside the warden. He felt as if he were plunging his hand into a bowl of hot bread dough. He released both objects and withdrew his hand. The warden didn't move. The bracelet and the cradle remained where Troy left them inside the warden's body.

"From the very beginning I realized that the bracelet you gave me enabled me to have special powers, talents that were not naturally mine. I understood, without knowing the specifics, that there would be a substantial and continuing reward for my helping you. And I thought that finally, finally, Troy Jefferson would be somebody special in this world."

Troy walked past the amazed Commander Winters, who was following the proceedings with a peaceful detachment, and came up beside Nick and Carol. It was absolutely quiet in the room. "When my brother, Jamie, was killed," he began again softly, "I swore that I would do whatever was necessary to leave my imprint on society. During those two years that I wandered all over the country, I spent most of my time daydreaming. My dreams all had the same conclusion. I would discover something new and earthshaking and become both rich and famous overnight."

Troy gave Carol a quick kiss and winked. "I love you, angel," he said. "And you too, Professor." Troy then turned around and faced the covered cylinder. "When I left here on Thursday afternoon, I was so excited I couldn't contain myself. I kept saymg, 'Shit, Jefferson, here it is. You are going to be the most important man in the history of the fucking world.' "

Troy paused. "But I have learned something very important these last three days," he said, "something that most of us probably never consider. It is that the process is more important than the end result. It is what you learn while you're dreaming or scheming or working toward a goal that is essential and valuable, not the achievement of the goal itself. And that's why you guys must now do what my friends have asked.

"I know that you ETs have tried to explain to me in these last several minutes, through the bracelet that you offered me for life, that the new humans you are depositing here will lead us primitive beings into a bold and wonderful era. That may be true. And I agree that we could use some help, that our species is full of prejudice and selfishness and all kinds of other problems. But you cannot simply give us the answers. Without the benefit of the struggle to improve ourselves, without the process of overcoming our own weaknesses, there will be no fundamental change in us old humans. We will not become better. We will become second-class citizens, acolytes in a future of your vision and design. So take your perfect humans away and let us make it on our own. We deserve the chance."

There was no movement in the room for several seconds after Troy finished. Then the warden in front of him jerked sideways and began to move. Troy braced for an attack. But the warden moved in the direction of the exit next to the cylinder. The bracelet and cradle could still be seen inside its body.

"All right, team," Troy shouted happily. Nick and Carol hugged. Troy took Commander Winters by the hand. As they were leaving, the four of them turned around one last time to look at the large chamber. In this final view, each one of them saw the room in terms of his own amazing experiences. The noises had begun again behind the walls. And the carpets, platforms, and wardens were filing out of the room through the door beside the covered cylinder.

They had only been onboard the boat for three or four minutes when the water underneath them suddenly became very turbulent. They were strangely quiet, all four of them. A frustrated Lieutenant Ramirez paced about the deck,

trying to get someone to tell him what had happened under the water. Even Commander Winters virtually ignored the lieutenant and just shook his head or gave simple answers to all his questions.

They were certain that the spaceship was about to launch. They didn't realize that it would glide gently away from their area first, so that it would not submerge them with a giant wave, before breaking the water and heading into the sky. The water stayed agitated for several minutes. All of them scanned the ocean for a sign of the vehicle.

"Look," yelled Commander Winters excitedly, pointing at a giant silver bird lifting into the sky about forty-five degrees away from the early morning sun. Its rise was initially slow, but as it rose it accelerated rapidly. Nick and Carol and Troy clasped hands tightly as they watched the awesome spectacle. Winters came over and stood beside the trio. After thirty seconds the craft had disappeared above the clouds. There was never any sound.

"Fantastic," said Commander Winters.

ENCOUTNER AT DAWN (Originally published as “Encounter In The Dawn” 1953 by Ziff - Davis Publishing Co.

Arthur C. Clarke

It was in the last days of the Empire. The tiny ship was far from home, and almost a hundred light-years from the great parent vessel searching through the loosely packed stars at the rim of the Milky Way. But even here it could not escape from the shadow that lay across civilization: beneath that shadow, pausing ever and again in their work to wonder how their distant homes were faring, the scientists of the Galactic Survey still labored at their never-ending task.

The ship held only three occupants, but between them they carried knowledge of many sciences, and the experience of half a lifetime in space. After the long interstellar night, the star ahead was warming their spirits as they dropped down toward its fires. A little more golden, a trifle more brilliant than the sun that now seemed a legend of their childhood. They knew from past experience that the chance of locating planets here was more than ninety per cent, and for the moment they forgot all else in the excitement of discovery.

They found the first planet within minutes of coming to rest. It was a giant, of a familiar type, too cold for protoplasmic life and probably possessing no stable surface. So they turned their search sunward, and presently were rewarded.

It was a world that made their hearts ache for home, a world where everything was hauntingly familiar, yet never quite the same. Two great land masses floated in blue-green seas, capped by ice at either pole. There were some desert regions, but the larger part of the planet was obviously fertile. Even from this distance, the signs of vegetation were unmistakably clear.

They gazed hungrily at the expanding landscape as they fell down into the atmosphere, heading toward noon in the subtropics. The ship plummeted through cloudless skies toward a great river, checked its fall with a surge of soundless power, and came to rest among the long grasses by the water’s edge.

No one moved: there was nothing to be done until the automatic instruments had finished their work. Then a bell tinkled softly and the lights on the control board flashed in a pattern of meaningful chaos. Captain Altman rose to his feet with a sigh of relief.

“We’re in luck,” he said. “We can go outside without protection, if the pathogenic tests are satisfactory. What did you make of the place as we came in, Bertrond?”

“Geologically stable-no active volcanoes, at least. I didn’t see any trace of cities, but that proves nothing. If there’s a civilization here, it may have passed that stage.”

“Or not reached it yet?”

Bertrond shrugged. “Either’s just as likely. It may take us some time to find out on a planet this size.”

“More time than we’ve got,” said Clindar, glancing at the communications panel that linked them to the mother ship and thence to the Galaxy’s threatened heart. For a moment there was a gloomy silence. Then Clindar walked to the control board and pressed a pattern of keys with automatic skill.

With a slight jar, a section of the hull slid aside and the fourth member of the crew stepped out onto the new planet, flexing metal limbs and adjusting servo motors to the unaccustomed gravity. Inside the ship, a television screen glimmered into life, revealing a long vista of waving grasses, some trees in the middle distance, and a glimpse of the great river. Clindar punched a button, and the picture flowed steadily across the screen as the robot turned its head.

"Which way shall we go?" Clindar asked.

"Let's have a look at those trees," Altman replied. "If there's any animal life we'll find it there."

"Look!" cried Bertrond. "A bird!"

Clindar's fingers flew over the keyboard: the picture centered on the tiny speck that had suddenly appeared on the left of the screen, and expanded rapidly as the robot's telephoto lens came into action.

"You're right," he said. "Feathers-beak-well up the evolutionary ladder. This place looks promising. I'll start the camera."

The swaying motion of the picture as the robot walked forward did not distract them: they had grown accustomed to it long ago. But they had never become reconciled to this exploration by proxy when all their impulses cried out to them to leave the ship, to run through the grass and to feel the wind blowing against their faces. Yet it was too great a risk to take, even on a world that seemed as fair as this. There was always a skull hidden behind Nature's most smiling face. Wild beasts, poisonous reptiles, quagmires-death could come to the unwary explorer in a thousand disguises. And worst of all were the invisible enemies, the bacteria and viruses against which the only defense might often be a thousand light years away.

A robot could laugh at all these dangers and even if, as sometimes happened, it encountered a beast powerful enough to destroy it-well, machines could always be replaced.

They met nothing on the walk across the grasslands. If any small animals were disturbed by the robot's passage, they kept outside its field of vision. Clindar slowed the machine as it approached the trees, and the watchers in the spaceship flinched involuntarily at the branches that appeared to slash across their eyes. The picture dimmed for a moment before the controls readjusted themselves to the weaker illumination; then it came back to normal.

The forest was full of life. It lurked in the undergrowth, clambered among the branches, flew through the air. It Red chattering and gibbering through the trees as the robot advanced. And all the while the automatic cameras were recording the pictures that formed on the screen, gathering material for the biologists to analyze when the ship returned to base.

Clindar breathed a sigh of relief when the trees suddenly thinned. It was exhausting work, keeping the robot from smashing into obstacles as it moved through the forest, but on open ground it could take care of itself. Th6n the picture trembled as if beneath a hammer-blow, there was a grinding metallic thud, and the whole scene swept vertiginously upward as the robot toppled and fell.

"What's that?" cried Altman. "Did you trip?"

"No," said Clindar grimly, his fingers flying over the keyboard.

"Something attacked from the rear. I hope . . . ah . . . I've still got control."

He brought the robot to a sitting position and swiveled its head. it did not take long to find the cause of the trouble. Standing a few feet away, and lashing its tail angrily, was a large quadruped with a most ferocious set of teeth. At the moment it was, fairly obviously, trying to decide whether to attack again.

Slowly, the robot rose to its feet, and as it did so the great beast crouched to spring. A smile flitted across Clindar's face: he knew how to deal with this situation, His thumb felt for the seldom-used key labeled "Siren."

The forest echoed with a hideous undulating scream from the robot's concealed speaker, and the machine advanced to meet its adversary, arms flailing in front of it. The startled beast almost fell over backward in its effort to turn, and in seconds was gone from sight.

"Now I suppose well have to wait a couple of hours until everything comes out of hiding again," said Bertrond ruefully.

"I don't know much about animal psychology," interjected Altman, "but is it usual for them to attack something completely unfamiliar?"

"Some will attack anything that moves, but that's unusual. Normally they attack only for food, or if they've already been threatened. What are you driving at? Do you suggest that there are other robots on this planet?"

"Certainly not. But our carnivorous friend may have mistaken our machine for a more edible biped. Don't you think that this opening in the jungle is rather unnatural? It could easily be a path."

"In that case," said Clindar promptly, "we'll follow it and find out. I'm tired of dodging trees, but I hope nothing jumps on us again: it's bad for my nerves."

"You were right, Altman," said Bertrond a little later. "It's certainly a path. But that doesn't mean intelligence. After all, animals-,,

He stopped in mid-sentence, and at the same instant Clindar brought the advancing robot to a halt. The path had suddenly opened out into a wide clearing, almost completely occupied by a village of flimsy huts. It was ringed by a wooden palisade, obviously defense against an enemy who at the moment presented no threat.

For the gates were wide open, and beyond them the inhabitants were going peacefully about their ways.

For many minutes the three explorers stared in silence at the screen. Then Clindar shivered a little and remarked: "It's uncanny. It might be our own planet, a hundred thousand years ago. I feel as if I've gone back in time."

"There's nothing weird about it," said the practical Altman. "After all, we've discovered nearly a hundred planets with our type of life on them."

"Yes," retorted Clindar. "A hundred in the whole Galaxy! I still think it's strange it had to happen to us."

"Well, it had to happen to somebody," said Bertrond philosophically. "Meanwhile, we must work out our contact procedure. If we send the robot into the village it will start a panic."

"That," said Altman, "is a masterly understatement. What we'll have to do is catch a native by himself and prove that we're friendly. Hide the robot, Clindar. Somewhere in the woods where it can watch the village without being spotted. We've a week's practical anthropology ahead of us!"

It was three days before the biological tests showed that it would be safe to leave the ship. Even then Bertrond insisted on going alone-alone, that is, if one ignored the substantial company of the robot. With such an ally he was not afraid of this planet's larger beasts, and his body's natural defenses could take care of the microorganisms. So, at least, the analyzers had assured him; and considering the complexity of the problem, they made remarkably few mistakes . . .

He stayed outside for an hour, enjoying himself cautiously, while his companions watched with envy. It would be another three days before they could be quite certain that it was safe to follow Bertrond's example. Meanwhile, they kept busy enough watching the village through the lenses of the robot, and recording everything they could with the cameras. They had moved the spaceship at night so that it was hidden in the depths of the forest, for they did not wish to be discovered until they were ready.

And all the while the news from home grew worse. Though their remoteness here at the edge of the Universe deadened its impact, it lay heavily on their minds and sometimes overwhelmed them with a sense of futility. At any moment, they knew, the signal

for recall might come as the Empire summoned up its last resources in its extremity. But until then they would continue their work as though pure knowledge were the only thing that mattered.

Seven days after landing, they were ready to make the experiment. They knew now what paths the villagers used when going hunting, and Bertrond chose one of the less frequented ways. Then he placed a chair firmly in the middle of the path and settled down to read a book.

It was not, of course, quite as simple as that: Bertrond had taken-all imaginable precautions. Hidden in the undergrowth fifty yards away, the robot was watching through its telescopic lenses, and in its hand it held a small but deadly weapon. Controlling it from the spaceship, his fingers poised over the keyboard, Clindar waited to do what might be necessary.

That was the negative side of the plan: the positive side was more obvious. Lying at Bertrond's feet was the carcass of a small, homed animal which he hoped would be an acceptable gift to any hunter passing this way.

Two hours later the radio in his suit harness whispered a warning. Quite calmly, though the blood was pounding in his veins, Bertrond laid aside his book and looked down the trail. The savage was walking forward confidently enough, swinging a spear in his right hand. He paused for a moment when he saw Bertrond, then advanced more cautiously. He could tell that there was nothing to fear, for the stranger was slightly built and obviously unarmed.

When only twenty feet separated them, Bertrond gave a reassuring smile and rose slowly to his feet. He bent down, picked up the carcass, and carried it forward as an offering. The gesture would have been understood by any creature on any world, and it was understood here. The savage reached forward, took the animal, and threw it effortlessly over his shoulder. For an instant he stared into Bertrond's eyes with a fathomless expression; then he turned and walked back toward the village. Three times he glanced round to see if Bertrond was following, and each time Bertrond smiled and waved reassurance. The whole episode lasted little more than a minute. As the first contact between two races it was completely without drama, though not without dignity.

Bertrond did not move until the other had vanished from sight. Then he relaxed and spoke into his suit microphone.

"That was a pretty good beginning," he said jubilantly. "He wasn't in the least frightened, or even suspicious. I think he'll be back."

"It still seems too good to be true," said Altman's voice in his ear. "I should have thought he'd have been either scared or hostile. Would you have accepted a lavish gift from a peculiar stranger with such little fuss?"

Bertrond was slowly walking back to the ship. The robot had now come out of cover and was keeping guard a few paces behind him.

"I wouldn't," he replied, "but I belong to a civilized community. Complete savages may react to strangers in many different ways, according to their past experience. Suppose this tribe has never had any enemies. That's quite possible on a large but sparsely populated planet. Then we may expect curiosity, but no fear at all."

"If these people have no enemies," put in Clindar, no longer fully occupied in controlling the robot, "why have they got a stockade round the village?"

"I meant no human enemies," replied Bertrond. "If that's true, it simplifies our task immensely."

"Do you think he'll come back?"

"Of course. If he's as human as I think, curiosity and greed will make him return. In a couple of days we'll be bosom friends."

Looked at dispassionately, it became a fantastic routine. Every morning the robot would go hunting under Clindar's direction, until it was now the deadliest killer in the jungle. Then Bertrond would wait until Yaan-which was the nearest they could get to his name-came striding confidently along the path. He came at the same time every day, and he always came alone. They wondered about this: did he wish to keep his great discovery to himself and thus get all the credit for his hunting prowess? If so, it showed unexpected foresight and cunning.

At first Yaan had departed at once with his prize, as if afraid that the donor of such a generous gift might change his mind. Soon, however, as Bertrond had hoped, he could be induced to stay for a while by simple conjuring tricks and a display of brightly colored fabrics and crystals, in which he took a childlike delight. At last

Bertrond was able to engage him in lengthy conversations, all of which were recorded as well as being filmed through the eyes of the hidden robot.

one day the philologists might be able to analyze this material; the best that Bertrond could do was to discover the meanings of a few simple verbs and nouns. This was made more difficult by the fact that Yaan not only used different words for the same thing, but sometimes the same word for different things.

Between these daily interviews, the ship traveled far, surveying the planet from the air and sometimes landing for more detailed examinations. Although several other human settlements were observed, Bertrond made no attempt to get in touch with them, for it was easy to see that they were all at much the same cultural level as Yaan's people.

it was, Bertrond often thought, a particularly bad joke on the part of Fate that one of the Galaxy's very few truly human races should have been discovered at this moment of time. Not long ago this would have been an event of supreme importance; now civilization was too hard-pressed to concern itself with these savage cousins waiting at the dawn of history.

Not until Bertrond was sure he had become part of Yaan's everyday life did he introduce him to the robot. He was showing Yaan the patterns in a kaleidoscope when Clindar brought the machine striding through the grass with its latest victim dangling across one metal arm. For the first time Yaan showed something akin to fear; but he relaxed at Bertrond's soothing words, though he continued to watch the advancing monster. It halted some distance away, and Bertrond walked forward to meet it. As he did so, the robot raised its arms and handed him the dead beast. He took it solemnly and carried it back to Yaan, staggering a little under the unaccustomed load.

Bertrond would have given a great deal to know just what Yaan was thinking as he accepted the gift. Was he trying to decide whether the robot was master or slave? Perhaps such conceptions as this were beyond his grasp: to him the robot might be merely another man, a hunter who was a friend of Bertrond.

Clindar's voice, slightly larger than life, came from the robot's speaker.

"It's astonishing how calmly he accepts us. Won't anything scare him?"

"You will keep judging him by your own standards," replied Bertrond. "Remember, his psychology is completely different, and much simpler. Now that he has confidence in me, anything that I accept won't worry him."

"I wonder if that will be true of all his race?" queried Altman. "It's hardly safe to judge by a single specimen. I want to see what happens when we send the robot into the village."

"Hello!" exclaimed Bertrond. "That surprised him. He's never met a person who could speak with two voices before."

"Do you think he'll guess the truth when he meets us?" said Clindar.

"No. The robot will be pure magic to him-but it won't be any more wonderful than fire and lightning and all the other forces he must already take for granted."

"Well, what's the next move?" asked Altman, a little impatiently. "Are you going to bring him to the ship, or will you go into the village first?"

Bertrond hesitated. "I'm anxious not to do too much too quickly. You know the accidents that have happened with strange races when that's been tried. I'll let him think this over, and when we get back tomorrow I'll try to persuade him to take the robot back to the village."

In the hidden ship, Clindar reactivated the robot and started it moving again. Like Altman, he was growing a little impatient of this excessive caution, but on all matters relating to alien life-forms Bertrond was the expert, and they had to obey his orders.

There were times now when he almost wished he were a robot himself, devoid of feelings or emotions, able to watch the fall of a leaf or the death agonies of a world with equal detachment . . .

The sun was low when Yaan heard the great voice crying from the jungle. He recognized it at once, despite its inhuman volume: it was the voice of his friend, and it was calling him.

In the echoing silence, the life of the village came to a stop. Even the children ceased their play: the only sound was the thin cry of a baby frightened by the sudden silence.

All eyes were upon Yaan as he walked swiftly to his hut and

grasped the spear that lay beside the entrance. The stockade would soon be closed against the prowlers of the night, but he did not hesitate as he stepped out into the lengthening shadows. He was passing through the gates when once again that mighty voice summoned him, and now it held a note of urgency that came clearly across all the barriers of language and culture.

The shining giant who spoke with many voices met him a little way from the village and beckoned him to follow. There was no sign of Bertrond. They walked for almost a mile before they saw him in the distance, standing not far from the river's edge and staring out across the dark, slowly moving waters.

He turned as Yaan approached, yet for a moment seemed unaware of his presence. Then he gave a gesture of dismissal to the shining one, who withdrew into the distance.

Yaan waited. He was patient and, though he could never have expressed it in words, contented. When he was with Bertrond he felt the first intimations of that selfless, utterly irrational devotion his race would not fully achieve for many ages.

It was a strange tableau. Here at the river's brink two men were standing. One was dressed in a closely-fitting uniform equipped with tiny, intricate mechanisms. The other was wearing the skin of an animal and was carrying a flint-tipped spear. Ten thousand generations lay between them, ten thousand generations and an immeasurable gulf of space. Yet they were both human. As she must do often in eternity, Nature had repeated one of her basic patterns.

Presently Bertrond began to speak, walking to and fro in short, quick steps as he did, and in his voice there was a trace of madness.

"It's all over, Yaan. I'd hoped that with our knowledge we could have brought you out of barbarism in a dozen generations, but now you will have to fight your way up from the jungle alone, and it may take you a million years to do so. I'm sorry-there's so much we could have done. Even now I wanted to stay here, but Altman and Clindar talk of duty, and I suppose that they are right. There is little enough that we can do, but our world is calling and we must not forsake it.

"I wish you could understand me, Yaan. I wish you knew what was saying. I'm leaving you these tools: some of them you will discover how to use, though as likely as not in a generation they'll be lost or forgotten. See how this blade cuts: it will be ages before

your world can make its like. And guard this well: when you press the button-look! If you use it sparingly, it will give you light for years, though sooner or later it will die. As for these other things find what use for them you can.

"Here come the first stars, up there in the east. Do you ever look at the stars, Yaan? I wonder how long it will be before you have discovered what they are, and I wonder what will have happened to us by then. Those stars are our homes, Yaan, and we cannot save them. Many have died already, in explosions so vast that I can imagine them no more than you. In a hundred thousand of your years, the light of those funeral pyres will reach your world and set its peoples wondering. By then, perhaps, your race will be reaching for the stars. I wish I could warn you against the mistakes we made, and which now will cost us all that we have won.

"It is well for your people, Yaan, that your world is here at the frontier of the Universe. You may escape the doom that waits for us. One day, perhaps, your ships will go searching among the stars as we have done, and they may come upon the ruins of our worlds and wonder who we were. But they will never know that we met here by this river when your race was young.

"Here come my friends; they would give me no more time. Good-by, Yaan-use well the things I have left you. They are your world's greatest treasures."

Something huge, something that glittered in the starlight, was sliding down from the sky. It did not reach the ground, but came to rest a little way above the surface, and in utter silence a rectangle of light opened in its side. The shining giant appeared out of the night and stepped through the golden door. Bertrond followed, pausing for a moment at the threshold to wave back at Yaan. Then the darkness closed behind him.

No more swiftly than smoke drifts upward from a fire, the ship lifted away. When it was so small that Yaan felt he could hold it in his hands, it seemed to blur into a long line of light slanting upward into the stars. From the empty sky a peal of thunder echoed over the sleeping land; and Yaan knew at last that the gods were gone and would never come again.

For a long time he stood by the gently moving waters, and into his soul there came a sense of loss he was never to forget and never

to understand. Then, carefully and reverently, he collected together the gifts that Bertrond had left.

Under the stars, the lonely figure walked homeward across a nameless land. Behind him the river flowed softly to the sea, winding through the fertile plains on which, more than a thousand centuries ahead, Yaan's descendants would build the great city they were to call Babylon.

Hide and Seek

Arthur C. Clarke

1949 Street & Smith Publications Inc.

We were walking back through the woods when Kingman saw the gray squirrel. Our bag was a small but varied one -three grouse, four rabbits (one, I am sorry to say, an infant in arms) and a couple of pigeons. And contrary to certain dark forecasts, both the dogs were still alive.

The squirrel saw us at the same moment. It knew that it was marked for immediate execution as a result of the damage it had done to the trees on the estate, and perhaps it had lost close relatives to Kingman's gun. In three leaps it had reached the base of the nearest tree, and vanished behind it in a flicker of gray. We saw its face once more, appearing for a moment round the edge of its shield a dozen feet from the ground; but though we waited, with guns leveled hopefully at various branches, we never saw it again.

Kingman was very thoughtful as we walked back across the lawn to the magnificent old house. He said nothing as we handed our victims to the cook-who received them without much enthusiasm-and only emerged from his reverie when we were sitting in the smoking room and he remembered his duties as a host.

"That tree-rat," he said suddenly (he always called them "tree rats," on the grounds that people were too sentimental to shoot the dear little squirrels), "it reminded me of a very peculiar experience that happened shortly before I retired. Very shortly indeed, in fact."

"I thought it would," said Carson dryly. I gave him a glare: he'd been in the Navy and had heard Kingman's stories before, but they Were still new to me.

"Of course," Kingman remarked, slightly nettled, "if you'd rather I didn't . . . "

"Do go on," I said hastily. "You've made me curious. What connection there can possibly be between a gray squirrel and the Second Jovian War I can't imagine."

Kingman seemed mollified.

"I think I'd better change some names," he said thoughtfully, "but I won't alter the places. The story begins about a million kilometers sunward of Mars . . ."

K.15 was a military intelligence operative. It gave him considerable pain when unimaginative people called him a spy, but at the moment he had much more substantial grounds for complaint. For some days now a fast enemy cruiser had been coming up astern, and though it was flattering to have the undivided attention of such a fine ship and so many highly trained men, it was an honor that K.15 would willingly have forgone.

What made the situation doubly annoying was the fact that his friends would be meeting him off Mars in about twelve hours, aboard a ship quite capable of dealing with a mere cruiser-from which you will gather that K.15 was a person of some importance. Unfortunately, the most optimistic calculation showed that the pursuers would be within accurate gun range in six hours. In some six

hours five minutes, therefore, K. 15 was likely to occupy an extensive and still expanding volume of space.

There might just be time for him to land on Mars, but that would be one of the worst things he could do. It would certainly annoy the aggressively neutral Martians, and the political complications would be frightful. Moreover, if his friends had to come down to the planet to rescue him, it would cost them more than ten kilometers a second in fuel-most of their operational reserve.

He had only one advantage, and that a very dubious one. The commander of the cruiser might guess that he was heading for a rendezvous, but he would not know how close it was or how large was the ship that was coming to meet him. If he could keep alive for only twelve hours, he would be safe. The "if" was a somewhat considerable one.

K.15 looked moodily at his charts, wondering if it was worthwhile to burn the rest of his fuel in a final dash. But a dash to where? He would be completely helpless then, and the pursuing ship might still have enough in her tanks to catch him as he flashed

outward into the empty darkness, beyond all hope of rescue-passing his friends as they came sunward at a relative speed so great that they could do nothing to save him.

With some people, the shorter the expectation of life, the more sluggish are the mental processes. They seem hypnotized by the approach of death, so resigned to their fate that they do nothing to avoid it. K.15, on the other hand, found that his mind worked better in such a desperate emergency. It began to work now as it had seldom done before.

Commander Smith-the name will do as well as any other-of the cruiser Doradus was not unduly surprised when K.15 began to decelerate. He had half expected the spy to land on Mars, on the principle that internment was better than annihilation, but when the plotting room brought the news that the little scout ship was heading for Phobos, he felt completely baffled. The inner moon was nothing but a jumble of rock some twenty kilometers across, and not even the economical Martians had ever found any use for it. K.15 must be pretty desperate if he thought it was going to be of any greater value to him.

The tiny scout had almost come to rest when the radar operator lost it against the mass of Phobos. During the braking maneuver, K.15 had squandered most of his lead and the Doradus was now only minutes away-though she was now beginning to decelerate lest she overrun him. The cruiser was scarcely three thousand kilometers from Phobos when she came to a complete halt: of K.15's ship, there was still no sign. It should be easily visible in the telescopes, but it was probably on the far side of the little moon.

It reappeared only a few minutes later, traveling under full thrust on a course directly away from the sun. It was accelerating at almost five gravities-and it had broken its radio silence. An automatic recorder was broadcasting over and over again this interesting message:

"I have landed on Phobos and am being attacked by a Z-class cruiser. Think I can hold out until you come, but hurry."

The message wasn't even in code, and it left Commander Smith a sorely puzzled man. The assumption that K.15 was still aboard the ship and that the whole thing was a ruse was just a little too naive. But it might be a double-bluff: the message bad obviously been left in plain language so that he would receive it and be duly

confused. He could afford neither the time nor the fuel to chase the scout if K. 15 really had landed. It was clear that reinforcements were on the way, and the sooner he left the vicinity the better. The phrase "Think I can hold out until you come" might be a piece of sheer impertinence, or it might mean that help was very near indeed.

Then K.15's ship stopped blasting. It had obviously exhausted its fuel, and was doing a little better than six kilometers a second away from the sun. K.15 must have landed, for his ship was now speeding helplessly out of the solar system. Commander Smith didn't like the message it was broadcasting, and guessed that it was running into the track of an approaching warship at some indefinite distance, but there was nothing to be done about that. The Doradus began to move toward Phobos, anxious to waste no time.

On the face of it, Commander Smith seemed the master of the situation. His ship was armed with a dozen heavy guided missiles and two turrets of electro-magnetic guns. Against him was one man in a space-suit, trapped on a moon only twenty kilometers across. It was not until Commander Smith had his first good look at Phobos, from a distance of less than a hundred kilometers, that he began to realize that, after all, K. 15 might have a few cards up his sleeve.

To say that Phobos has a diameter of twenty kilometers, as the astronomy books invariably do, is highly misleading. The word "diameter" implies a degree of symmetry which Phobos most certainly lacks. Like those other lumps of cosmic slag, the asteroids, it is a shapeless mass of rock floating in space with, of course, no hint of an atmosphere and not much more gravity. It turns on its axis once every seven hours thirty-nine minutes, thus keeping the same face always to Mars-which is so close that appreciably less than half the planet is visible, the poles being below the curve of the horizon. Beyond this, there is very little more to be said about Phobos.

K. 15 had no time to enjoy the beauty of the crescent world filling the sky above him. He had thrown all the equipment he could carry out of the airlock, set the controls, and jumped. As the little ship went flaming out toward the stars he watched it go with feelings he did not care to analyze. He had burned his boats with a vengeance, and he could only hope that the oncoming battleship would intercept the radio message as the empty vessel went racing

by into nothingness. There was also a faint possibility that the enemy cruiser might 90 in pursuit, but that was rather too much to hope for.

He turned to examine his new home. The only light was the ocher radiance of Mars, since the sun was below the horizon, but that was quite sufficient for his purpose and he could see very well. He stood in the center of an irregular plain about two kilometers across, surrounded by low hills over which he could leap rather easily if he wished. There was a story he remembered reading long ago about a man who had accidentally jumped off Phobos: that wasn't quite possible-though it was on Deimos-as the escape velocity was still about ten meters a second. But unless he was careful, he might easily find himself at such a height that it would take hours to fall back to the surface-and that would be fatal. For K. 15's plan was a simple one: he must remain as close to the surface of Phobos as possible-and diametrically opposite the cruiser. The Doradus could then fire all her armament against the twenty kilometers of rock, and he wouldn't even feel the concussion. There were only two serious dangers, and one of these did not worry him greatly.

To the layman, knowing nothing of the finer details of astronautics, the plan would have seemed quite suicidal. The Doradus was armed with the latest in ultra-scientific weapons: moreover, the twenty kilometers which separated her from her prey represented less than a second's flight at

maximum speed. But Commander Smith knew better, and was already feeling rather unhappy. He realized, only too well, that of all the machines of transport man has ever invented, a cruiser of space is far and away the least maneuverable. It was a simple fact that K. 15 could make half a dozen circuits of his little world while her commander was persuading the Doradus to make even one.

There is no need to go into technical details, but those who are still unconvinced might like to consider these elementary facts. A rocket-driven spaceship can, obviously, only accelerate along its major axis-that is, "forward." Any deviation from a straight course demands a physical turning of the ship, so that the motors can blast in another direction. Everyone knows that this is done by internal gyros or tangential steering jets, but very few people know just how long this simple maneuver takes. The average cruiser, fully fueled,

has a mass of two or three thousand tons, which does not make for rapid footwork. But things are even worse than this, for it isn't the mass, but the moment of inertia that matters here-and since a cruiser is a long, thin object, its moment of inertia is slightly colossal. The sad fact remains (though it is seldom mentioned by astronautical engineers) that it takes a good ten minutes to rotate a spaceship through 180 degrees, with gyros of any reasonable size. Control jets aren't much quicker, and in any case their use is restricted because the rotation they produce is permanent and they are liable to leave the ship spinning like a slow-motion pinwheel, to the annoyance of all inside.

In the ordinary way, these disadvantages are not very grave. One has millions of kilometers and hundreds of hours in which to deal with such minor matters as a change in the ship's orientation. It is definitely against the rules to move in ten-kilometer radius circles, and the commander of the Doradus felt distinctly aggrieved, K. 15 wasn't playing fair.

At the same moment that resourceful individual was taking stock of the situation, which might very well have been worse. He had reached the hills in three jumps and felt less naked than he had out in the open plain. The food and equipment he had taken from the ship he had hidden where he hoped he could find it again, but as his suit could keep him alive for over a day that was the least of his worries. The small packet that was the cause of all the trouble was still with him, in one of those numerous hiding places a well-designed space-suit affords.

There was an exhilarating loneliness about his mountain eyrie, even though he was not quite as lonely as he would have wished. Forever fixed in his sky, Mars was waning almost visibly as Phobos swept above the night side of the planet. He could just make out the lights of some of the Martian cities, gleaming pin-points marking the junctions of the invisible canals. All else was stars and silence and a line of jagged peaks so close it seemed he could almost touch them. Of the Doradus there was still no sign. She was

presumably carrying out a careful telescopic examination of the Le: lighted side of Phobos.

Mars was a very useful clock: when it was half full the sun would rise and, very probably, so would the Doradus. But she might approach from some quite unexpected quarter: she might

even-and this was the one real danger-she might even have landed a search party.

This was the first possibility that had occurred to Commander Smith when he saw just what he was up against. Then he realized that the surface area of Phobos was over a thousand square kilometers and that he could not spare more than ten men from his crew to make a search of that jumbled wilderness. Also, K. 15 would certainly be armed.

Considering the weapons which the Doradus carried, this last objection might seem singularly pointless. It was very far from being so. In the ordinary course of business, side-arms and other portable weapons are as much use to a space-cruiser as are cutlasses and crossbows. The Doradus happened, quite by chance-and against regulations at that-to carry one automatic pistol and a hundred rounds of ammunition. Any search party would therefore consist of a group of unarmed men looking for a well concealed and very desperate individual who could pick them off at his leisure. K.15 was breaking the rules again.

The terminator of Mars was now a perfectly straight line, and at almost the same moment the sun came up, not so much like thunder as like a salvo of atomic bombs. K.15 adjusted the filters of his visor and decided to move. It was safer to stay out of the sunlight, not only because here he was less likely to be detected in the shadow but also because his eyes would be much more sensitive there. He had only a pair of binoculars to help him, whereas the Doradus would carry an electronic telescope of twenty centimeters aperture at least.

It would be best, K. 15 decided, to locate the cruiser if he could. It might be a rash thing to do, but he would feel much happier when he knew exactly where she was and could watch her movements. He could then keep just below the horizon, and the glare of the rockets would give him ample warning of any impending move. Cautiously launching himself along an almost horizontal trajectory, he began the circumnavigation of his world.

The narrowing crescent of Mars sank below the horizon until only one vast horn reared itself enigmatically against the stars. K. 15 began to feel worried: there was still no sign of the Doradus. But this was hardly surprising, for she was painted black as night and might be a good hundred kilometers away in space. He stopped,

wondering if he had done the right thing after all. Then he noticed that something quite large was eclipsing the stars almost vertically overhead, and was moving swiftly even as he watched. His heart stopped for a moment: then he was himself again, analyzing the situation and trying to discover how he had made so disastrous a mistake.

It was some time before he realized that the black shadow slip)ping across the sky was not the cruiser at all, but something almost equally deadly. It was far smaller, and far nearer, than he had at first thought. The Doradus had sent her television-homing guided missiles to look for him-

This was the second danger he had feared, and there was nothing he could do about it except to remain as inconspicuous as possible. The Doradus now had many eyes searching for him, but these auxiliaries had very severe limitations. They had been built to look for sunlit spaceships against a background of stars, not to search for a man hiding in a dark jungle of rock. The definition of their television systems was low, and they could only see in the forward direction.

There were rather more men on the chessboard now, and the game was a little deadlier, but his was still the advantage.

The torpedo vanished into the night sky. As it was traveling on a nearly straight course in this low gravitational field, it would soon be leaving Phobos behind, and K. 15 waited for what he knew must happen. A few minutes later, he saw a brief stabbing of rocket exhausts and guessed that the projectile was swinging slowly back on its course. At almost the same moment he saw another flare far away in the opposite quarter of the sky, and wondered just how many of these infernal machines were in action. From what he knew of Z-class cruisers-which was a good deal more than he should there were four missile-control channels, and they were probably all in use.

He was suddenly struck by an idea so brilliant that he was quite sure it couldn't possibly work. The radio on his suit was a tunable one, covering an unusually wide band, and somewhere not far away the Doradus was pumping out power on everything from a thousand megacycles upward. He switched on the receiver and began to explore.

It came in quickly-the raucous whine of a pulse transmitter

not far away. He was probably only picking up a sub-harmonic, but that was quite good enough. It D/F'ed sharply, and for the first time K.15 allowed himself to make long-range plans about the future. The Doradus had betrayed herself: as long as she operated her missiles, he would know exactly where she was.

He moved cautiously forward toward the transmitter. To his surprise the signal faded, then increased sharply again. This puzzled him until he realized that he must be moving through a diffraction zone. its width might have told him something useful if he had been a good enough physicist, but he couldn't imagine what.

The Doradus was hanging about five kilometers above the surface, in full sunlight. Her "non-reflecting" paint was overdue for renewal, and K.15 could see her clearly. As he was still in darkness, and the shadow line was moving away from him, he decided that he was as safe here as anywhere. He settled down comfortably so that he could just see the cruiser and waited, feeling fairly certain that none of the guided projectiles would come so near the ship. By now, he calculated, the commander of the Doradus must be getting pretty mad. He was perfectly correct.

After an hour, the cruiser began to heave herself round with all the grace of a bogged hippopotamus. K. 15 guessed what was happening. Commander Smith was going to have a look at the antipodes, and was preparing for the perilous fifty-kilometer journey. He watched very carefully to see the orientation the ship was adopting, and when she came to rest again was relieved to see that she was almost broadside on to him. Then, with a series of jerks that could not have been very enjoyable aboard, the cruiser began to move down to the horizon. K. 15 followed her at a comfortable walking pace-if one could use the phrase-reflecting that this was a feat very few people had ever performed. He was particularly careful not to overtake her on one of his kilometer-long glides, and kept a close watch for any missiles that might be coming up astern.

It took the Doradus nearly an hour to cover the fifty kilometers. This, as K. 15 amused himself by calculating, represented considerably less than a thousandth of her normal speed. Once she found herself going off into space at a tangent, and rather than waste time turning end over end again fired off a salvo of shells to reduce speed. But she made it at last, and K.15 settled down for another

vigil, wedged between two rocks where he could just see the cruiser and he was quite sure she couldn't see him. It occurred to him that by this time Commander Smith might have grave doubts as to whether he really was on Phobos at all, and he felt like firing off a signal flare to reassure him. However, he resisted the temptation.

There would be little point in describing the events of the next ten hours, since they differed in no important detail from those that had gone before. The Doradus made three other moves, and K.15 stalked her with the care of a big-game hunter following the spoor of some elephantine beast. Once, when she would have led him out into full sunlight, he let her fall below the horizon until he could only just pick up her signals. But most of the time he kept her just visible, usually low down behind some convenient hill.

Once a torpedo exploded some kilometers away, and K. 15 guessed that some exasperated operator had seen a shadow he didn't like-or else that a technician had forgotten to switch off a proximity fuse. Otherwise nothing happened to enliven the proceedings: in fact, the whole affair was becoming rather boring. He almost welcomed the sight of an occasional guided missile drifting inquisitively overhead, for he did not believe that they could see him if he remained motionless and in reasonable cover. If he could have stayed on the part of Phobos exactly opposite the cruiser he would have been safe even from these, he realized, since the ship would have no control there in the moon's radio-shadow. But he could think of no reliable way in which he could be sure of staying in the safety zone if the cruiser moved again.

The end came very abruptly. There was a sudden blast of steering jets, and the cruiser's main drive burst forth in all its power and splendor. In seconds the Doradus was shrinking sunward, free at last, thankful to leave, even in defeat, this miserable lump of rock that had so annoyingly balked her of her legitimate prey. K. 15 knew what had happened, and a great sense of peace and relaxation swept over him. In the radar room of the cruiser, someone had seen an echo of disconcerting amplitude approaching with altogether excessive speed. K.15 now had only to switch on his suit beacon and to wait. He could even afford the luxury of a cigarette.

"Quite an interesting story," I said, "and I see now how it ties up with that squirrel. But it does raise one or two queries in my mind."

"Indeed?" said Rupert Kingman politely.

I always like to get to the bottom of things, and I knew that my host had played a part in the Jovian War about which he very seldom spoke. I decided to risk a long shot in the dark.

"May I ask how you happen to know so much about this unorthodox military engagement? It isn't possible, is it, that you were K. 15?"

There was an odd sort of strangling noise from Carson. Then Kingman said, quite calmly: "No, I wasn't."

He got to his feet and went off toward the gun room.

"If you'll excuse me a moment, I'm going to have another shot at that tree-rat. Maybe I'll get him this time." Then he was gone.

Carson looked at me as if to say: "This is another house you'll never be invited to again." When our host was out of earshot he remarked in a coldly cynical voice:

"You've done it. What did you have to say that for?"

"Well, it seemed a safe guess. How else could he have known all that?"

"As a matter of fact, I believe he met K. 15 after the War: they must have had an interesting conversation together. But I thought you knew that Rupert was retired from the service with only the rank of lieutenant commander. The Court of Inquiry could never see his point of view. After all, it just wasn't reasonable that the commander of the fastest ship in the Fleet couldn't catch a man in a 9ÍÁ…• "µÍÕ¥Ð¸^4

History Lesson

Arthur C. Clarke
1949 Better Publications Inc.

No one could remember when the tribe had begun its long journey. The land of great rolling plains that had been its first home was now no more than a half-forgotten dream.

For many years Shann and his people had been fleeing through a country of low hills and sparkling lakes, and now the mountains lay ahead. This summer they must cross them to the southern lands. There was little time to lose. The white terror that had come down from the Poles, grinding continents to dust and freezing the very air before it, was less than a day's march behind.

Shann wondered if the glaciers could climb the mountains ahead, and within his heart he dared to kindle a little flame of hope. This might prove a barrier against which even the remorseless ice would batter in vain. In the southern lands of which the legends spoke, his people might find refuge at last.

It took weeks to discover a pass through which the tribe and the animals could travel. When midsummer came, they had camped in a lonely valley where the air was thin and the stars shone with a brilliance no one had ever seen before.

The summer was waning when Shann took his two sons and went ahead to explore the way. For three days they climbed, and for three nights slept as best they could on the freezing rocks, and on the fourth morning there was nothing ahead but a gentle rise to a cairn of gray stones built by other travelers, centuries ago.

Shann felt himself trembling, and not with cold, as they walked toward the little pyramid of stones. His sons had fallen behind. No one spoke, for too much was at stake. In a little while they would know if all their hopes had been betrayed.

To east and west, the wall of mountains curved away as if embracing the land beneath. Below lay endless miles of undulating plain, with a great river swinging across it in tremendous loops. It was a fertile land; one in which the tribe could raise crops knowing that there would be no need to flee before the harvest came.

Then Shann lifted his eyes to the south, and saw the doom of all his hopes. For there at the edge of the world glimmered that deadly light he had seen so often to the north-the glint of ice below the horizon.

There was no way forward. Through all the years of flight, the glaciers from the south had been advancing to meet them. Soon they would be crushed beneath the moving walls of ice . . .

Southern glaciers did not reach the mountains until a generation later. In that last summer the sons of Shann carried the sacred treasures of the tribe to the lonely cairn overlooking the plain. The ice that had once gleamed below the horizon was now almost at their feet. By spring it would be splintering against the mountain walls.

No one understood the treasures now. They were from a past too distant for the understanding of any man alive. Their origins were lost in the mists that surrounded the Golden Age, and how they had come at last into the possession of this wandering tribe was a story that now would never be told. For it was the story of a civilization that had passed beyond recall.

Once, all these pitiful relics had been treasured for some good reason, and now they had become sacred though their meaning had long been lost. The print in the old books had faded centuries ago though much of the lettering was still visible-if there had been any to read it. But many generations had passed since anyone had had a use for a set of seven-figure logarithms, an atlas of the world, and the score of Sibelius' Seventh Symphony printed, according to the flyleaf, by H. K. Chu and Sons, at the City of Pekin in the year 2371 A.D.

The old books were placed reverently in the little crypt that had been made to receive them. There followed a motley collection of fragments-gold and platinum coins, a broken telephoto lens, a watch, a cold-light lamp, a microphone, the cutter from an electric razor, some midget radio tubes, the flotsam that had been left behind when the great tide of civilization had ebbed forever.

All these treasures were carefully stowed away in their resting place. Then came three more relics, the most sacred of all because the least understood.
The first was a strangely shaped piece of metal, showing the coloration of intense heat. It was, in its way, the most pathetic of all these, symbols from the past, for it told of man's greatest achievement and of the future he might have known. The mahogany stand on which it was mounted bore a silver plate with the inscription:
Auxiliary Igniter from Starboard Jet Spaceship "Morning Star" Earth-Moon, A.D. 1985
Next followed another miracle of the ancient science-a sphere of transparent plastic with strangely shaped pieces of metal imbedded in it. At its center was a tiny capsule of synthetic radio element, surrounded by the converting screens that shifted its radiation far down the spectrum. As long as the material remained active, the sphere would be a tiny radio transmitter, broadcasting power in all directions. Only a few of these spheres had ever been made.-They had been designed as perpetual beacons to mark the orbits of the asteroids. But man had never reached the asteroids and the beacons had never been used.

Last of all was a flat, circular tin, wide in comparison with its depth. It was heavily sealed, and rattled when shaken. The tribal lore predicted that disaster would follow if it was ever opened, and no one knew that it held one of the great works of art of nearly a thousand years before.
The work was finished. The two men rolled the stones back into place and slowly began to descend the mountainside. Even to the last, man had given some thought to the future and had tried to preserve something for posterity.
That winter the great waves of ice began their first assault on the mountains, attacking from north and south. The foothills were overwhelmed in the first onslaught, and the glaciers ground them into dust. But the mountains stood firm, and)When the summer came the ice retreated for a while.
So, winter after winter, the battle continued, and the roar of the avalanches, the grinding of rock and the explosions of splintering ice filled the air with tumult. No war of man's had been fiercer than this, and even man's battles had not quite engulfed the globe as this had done.

At last the tidal waves of ice began to subside and to creep slowly down the flanks of the mountains they had never quite subdued. The valleys and passes were still firmly in their grip. It was stalemate. The glaciers had met their match, but their defeat was too late to be of any use to man.
So the centuries passed, and presently there happened something that must occur once at least in the history of every world in the universe, no matter how remote and lonely it may be.
The ship from Venus came five thousand years too late, but its crew knew nothing of this. While still many millions of miles away, the telescopes had seen the

great shroud of ice that made Earth the most brilliant object in the sky next to the sun itself.

Here and there the dazzling sheet was marred by black specks that revealed the presence of almost buried mountains. That was all. The rolling oceans, the plains and forests, the deserts and lakes -all that had been the world of man was sealed beneath the ice, perhaps forever.
The ship closed in to Earth and established an orbit less than a thousand miles away. For five days it circled the planet, while cameras recorded all that was left to see and a hundred instruments gathered information that would give the Venusian scientists many years of work.

An actual landing was not intended. There seemed little purpose in it. But on the sixth day the picture changed. A panoramic monitor, driven to the limit of its amplification, detected the dying radiation of the five-thousand-year-old beacon. Through all the centuries, it had been sending out its signals with ever-failing strength as its radioactive heart steadily weakened.
The monitor locked on the beacon frequency. In the control room, a bell clamored for attention. A little later, the Venusian ship broke free from its orbit and slanted down toward Earth, toward a range of mountains that still towered proudly above the ice, and to a cairn of gray stones that the years had scarcely touched . . . .

The great disk of the sun blazed fiercely in a sky no longer veiled with mist, for the clouds that had once hidden Venus had now completely gone. Whatever force had caused the change in the sun's radiation had doomed one civilization, but had given birth to another. Less than five thousand years before, the half-savage people of Venus had seen sun and stars for the first time. Just as the science of Earth had begun with astronomy, so had that of Venus, and on the warm, rich world that man had never seen progress had been incredibly rapid.

Perhaps the Venusians had been lucky. They never knew the Dark Age that held man enchained for a thousand years. They missed the long detour into chemistry and mechanics but came at once to the more fundamental laws of radiation physics. In the time that man had taken to progress from the Pyramids to the rocket-propelled spaceship, the Venusians had passed from the discovery of agriculture to antigravity itself-the ultimate secret that man had never learned.
The warm ocean that still bore most of the young planet's life rolled its breakers languidly against the sandy shore. So new was this continent that the very sands were coarse and gritty. There had not yet been time enough for the sea to wear them smooth.

The scientists lay half in the water, their beautiful reptilian bodies gleaming in the sunlight. The greatest minds of Venus had gathered on this shore from all the islands of the planet. What they were going to hear they did not know, except that it concerned the Third World and the mysterious race that had peopled it before the coming of the ice.
. The Historian was standing on the land, for the instruments he wished to use had no love of water. By his side was a large machine which attracted many curious glances from his colleagues. It was clearly concerned with optics, for a lens system projected from it toward a screen of white material a dozen yards away.
The Historian began to speak. Briefly he recapitulated what little had been discovered concerning the Third Planet and its people.

He mentioned the centuries of fruitless research that had failed to interpret a single word of the writings of Earth. The planet had been inhabited by a race of

great technical ability. That, at least, was proved by the few pieces of machinery that had been found in the cairn upon the mountain.

"We do not know why so advanced a civilization came to an end," he observed. "Almost certainly, it had sufficient knowledge to survive an ice Age. There must have been some other factor of which we know nothing. Possibly disease or racial degeneration may have been responsible. It has even been suggested that the tribal conflicts endemic to our own species in prehistoric times may have continued on the Third Planet after the coming of technology.

"Some philosophers maintain that knowledge of machinery does not necessarily imply a high degree of civilization, and it is theoretically possible to have wars in a society possessing mechanical power, flight, and even radio. Such a conception is alien to our thoughts, but we must admit its possibility. It would certainly account for the downfall of the lost race.
"it has always been assumed that we should never know anything of the physical form of the creatures who lived on Planet Three. For centuries our artists have been depicting scenes from the history of the dead world, peopling it with all manner of fantastic beings. Most of these creations have resembled us more or less closely, though it has often been pointed out that because we are reptiles it does not follow that all intelligent life must necessarily be reptilian.
"We now know the answer to one of the most baffling problems of history. At last, after hundreds of years of research, we have discovered the exact form and nature of the ruling life on the Third Planet."

There was a murmur of astonishment from the assembled scientists. Some were so taken aback that they disappeared for a while into the comfort of the ocean, as all Venusians were apt to do in moments of stress. The Historian waited until his colleagues reemerged into the element they so disliked. He himself was quite comfortable, thanks to the tiny sprays that were continually playing over his body. With their help he could live on land for many hours before having to return to the ocean.
The excitement slowly subsided and the lecturer continued:
"One of the most puzzling of the objects found on Planet Three was a flat metal container holding a great length of transparent plastic material, perforated at the edges and wound tightly into a spool. This transparent tape at first seemed quite featureless, but an examination with the new subelectronic microscope has shown that this is not the case. Along the surface of the material, invisible to our eyes but perfectly clear under the correct radiation, are literally thousands of tiny pictures. It is believed that they were imprinted on the material by some chemical means, and have faded with the passage of time.

"These pictures apparently form a record of life as it was on the Third Planet at the height of its civilization. They are not independent. Consecutive pictures are almost identical, differing only in the detail of movement. The purpose of such a record is obvious. It is only necessary to project the scenes in rapid succession to give an illusion of continuous movement. We have made a machine to do this, and I have here an exact reproduction of the picture sequence.
"The scenes you are now going to witness take us back many thousands of years, to the great days of our sister planet. They show a complex civilization, many of whose activities we can only dimly understand. Life seems to have been very violent and energetic, and much that you will see is quite baffling.

"It is clear that the Third Planet was inhabited by a number of different species, none of them reptilian. That is a blow to our pride, but the conclusion is inescapable. The dominant type of life appears to have been a two-armed

biped. It walked upright and covered its body with some flexible material, possibly for protection against the cold, since even before the Ice Age the planet was at a much lower temperature than our own world. But I will not try your patience any further. You will now see the record of which I have been speaking."

A brilliant light flashed from the projector. There was a gentle whirring, and on the screen appeared hundreds of strange beings moving rather jerkily to and fro. The picture expanded to embrace one of the creatures, and the scientists could see that the Historian's description had been correct.

The creature possessed two eyes, set rather close together, but the other facial adornments were a little obscure. There was a large orifice in the lower portion of the head that was continually opening and closing. Possibly it had something to do with the creature's breathing.

The scientists watched spellbound as the strange being became involved in a series of fantastic adventures. There was an incredibly violent conflict with another, slightly different creature. It seemed
certain that they must both be killed, but when it was all over neither seemed any the worse.

Then came a furious drive over miles of country in a four wheeled mechanical device which was capable of extraordinary feats of locomotion. The ride ended in a city packed with other vehicles moving in all directions at breathtaking speeds. No one was surprised to see two of the machines meet head-on with devastating results.

After that, events became even more complicated. It was now quite obvious that it would take many years of research to analyze and understand all that was happening. It was also clear that the record was a work of art, somewhat stylized, rather than an exact reproduction of life as it actually had been on the Third Planet.

Most of the scientists felt themselves completely dazed when the sequence of pictures came to an end. There was a final flurry of motion, in which the creature that had been the center of interest became involved in some tremendous but incomprehensible catastrophe. The picture contracted to a circle, centered on the creature's head.

The last scene of all was an expanded view of its face, obviously expressing some powerful emotion. But whether it was rage, grief, defiance, resignation or some other feeling could not be guessed. The picture vanished. For a moment some lettering appeared on the screen, then it was all over.

For several minutes there was complete silence, save for the lapping of the waves upon the sand. The scientists were too stunned to speak. The fleeting glimpse of Earth's civilization had had a shattering effect on their minds. Then little groups began to start talking together, first in whispers and then more and more loudly as the implications of what they had seen became clearer.

Presently the Historian called for attention and addressed the meeting again. "We are now planning," he said, "a vast program of research to extract all available knowledge from this record. Thousands of copies are being made for distribution to all workers. You win appreciate the problems involved. The psychologists in particular have an immense task confronting them.

"But I do not doubt that we shall succeed. In another generation, who can say what we may not have learned of this wonderful race? Before we leave, let us look again at our remote cousins,

whose wisdom may have surpassed our own but of whom so little has survived."

Once more the final picture flashed on the screen, motionless this time, for the projector had been stopped. With something like awe, the scientists gazed at the stiff figure from the past, while in turn the little biped stared back at them with its characteristic expression of arrogant bad temper.

For the rest of time it would symbolize the human race. The psychologists of Venus would analyze its actions and watch its every movement until they could reconstruct its mind. Thousands of books would be written about it. Intricate philosophies would be contrived to account for its behavior.
But all. this labor, all this research, would be utterly in vain. Perhaps the proud and lonely figure on the screen was smiling sardonically at the scientists who were starting on their age-long fruitless quest.

Its secret would be safe as long as the universe endured, for no one now would ever read the lost language of Earth. Millions of times in the ages to come those last few words would flash across the screen, and none could ever guess their meaning:
.....A Walt Disney Production.

If I Forget Thee, Oh Earth

Arthur C. Clarke

1951 Columbia Publications

When Marvin was ten years old, his father took him through the long, echoing corridors that led up through Administration and Power, until at last they came to the uppermost levels of all and were among the swiftly growing vegetation of the Farmlands. Marvin liked it here: it was fun watching the great, slender plants creeping with almost visible eagerness toward the sunlight as it filtered down through the plastic domes to meet them. The smell of life was everywhere, awakening inexpressible longings in his heart: no longer was he breathing the dry, cool air of the residential levels, purged of all smells but the faint tang of ozone. He wished he could stay here for a little while, but Father would not let him. They went onward until they had reached the entrance to the Observatory, which he had never visited: but they did not stop, and Marvin knew with a sense of rising excitement that there could be only one goal left. For the first time in his life, he was going Outside.

There were a dozen of the surface vehicles, with their wide balloon tires and pressurized cabins, in the great servicing chamber. His father must have been expected, for they were led at once to the little scout car waiting by the huge circular door of the airlock. Tense with expectancy, Marvin settled himself down in the cramped cabin while his father started the motor and checked the controls. The inner door of the lock slid open and then closed behind them: he heard the roar of the great air pumps fade slowly away as the Pressure dropped to zero. Then the "Vacuum" sign flashed on, the Outer door parted, and before Marvin lay the land which he had never yet entered.

He had seen it in photographs, of course: he had watched it imaged on television screens a hundred times. But now it was lying all around him, burning beneath the fierce sun that crawled so slowly across the jet-black sky. He stared into the west, away from the blinding splendor of the sun-and there were the stars, as he had been told but had never quite believed. He gazed at them for a long time, marveling that anything could be so bright and yet so tiny. They were intense unscintillating points, and suddenly he remembered a rhyme he had once read in one of his father's books:

Twinkle, twinkle, little star, How I wonder what you are.

Well, he knew what the stars were. Whoever asked that question must have been very stupid. And what did they mean by "twinkle"? You could see at a glance that all the stars shone with the same steady, unwavering light. He abandoned the puzzle and turned his attention to the landscape around him.

They were racing across a level plain at almost a hundred miles an hour, the great balloon tires sending up little spurts of dust behind them. There was no sign of the Colony: in the few minutes while he had been gazing at the stars, its domes and radio towers had fallen below the horizon. Yet there were other indications of man's presence, for about a mile ahead Marvin could see the

curiously shaped structures clustering round the head of a mine. Now and then a puff of vapor would emerge from a squat smokestack and would instantly disperse.

They were past the mine in a moment: Father was driving with a reckless and exhilarating skill as if-it was a strange thought to come into a child's mind-he were trying to escape from something. In a few minutes they had reached the edge of the plateau on which the Colony had been built. The ground fell sharply away beneath them in a dizzying slope whose lower stretches were lost in shadow. Ahead, as far as the eye could reach, was a jumbled wasteland of craters, mountain ranges, and ravines. The crests of the mountains, catching the low sun, burned like islands of fire in a sea of darkness: and above them the stars still shone as steadfastly as ever.

There could be no way forward-yet there was. Marvin clenched his fists as the car edged over the slope and started the long descent. Then he saw the barely visible track leading down the mountain-

side, and relaxed a little. Other men, it seemed, had gone this way

before.

Night fell with a shocking abruptness as they crossed the shadow line and the sun dropped below the crest of the plateau. The twin searchlights sprang into life, casting blue-white bands on the rocks ahead, so that there was scarcely need to check their speed. For hours they drove through valleys and past the foot of mountains whose peaks seemed to comb the stars, and sometimes they emerged for a moment into the sunlight as they climbed over higher ground.

And now on the right was a wrinkled, dusty plain, and on the left, its ramparts and terraces rising mile after mile into the sky, was a wall of mountains that marched into the distance until its peaks sank from sight below the rim of the world. There was no sign that men had ever explored this land, but once they passed the skeleton of a crashed rocket, and beside it a stone cairn surmounted by a metal cross.

It seemed to Marvin that the mountains stretched on forever: but at last, many hours later, the range ended in a towering, precipitous headland that rose steeply from a cluster of little hills. They drove down into a shallow valley that curved in a great arc toward the far side of the mountains: and as they did so, Marvin slowly realized that something very strange was happening in the land ahead.

The sun was now low behind the hills on the right: the valley before them should be in total darkness. Yet it was awash with a cold white radiance that came spilling over the crags beneath which they were driving. Then, suddenly, they were out in the open plain, and the source of the light lay before them in all its glory.

It was very quiet in the little cabin now that the motors had stopped. The only sound was the faint whisper of the oxygen feed and an occasional metallic crepitation as the outer walls of the vehicle radiated away their heat. For no warmth at all came from the great silver crescent that floated low above the far horizon and flooded all this land with pearly light. It was so brilliant that minutes passed before Marvin could accept its challenge and look steadfastly into its glare, but at last he could discern the outlines of continents, the hazy border of the atmosphere, and the white islands of cloud.

And even at this distance, he could see the glitter of sunlight on the polar ice.

It was beautiful, and it called to his heart across the abyss of space. There in that shining crescent were all the wonders that he had never known-the hues of sunset skies, the moaning of the sea on pebbled shores, the patter of falling rain, the unhurried benison of snow. These and a thousand

others should have been his rightful heritage, but he knew them only from the books and ancient records, and the thought filled him with the anguish of exile.

Why could they not return? It seemed so peaceful beneath those lines of marching cloud. Then Marvin, his eyes no longer blinded by the glare, saw that the portion of the disk that should have been in darkness was gleaming faintly with an evil phosphorescence: and he remembered. He was looking upon the funeral pyre of a world -upon the radioactive aftermath of Armageddon. Across a quarter of a million miles of space, the glow of dying atoms was still visible, a perennial reminder of the ruinous past. It would be centuries yet before that deadly glow died from the rocks and life could return again to fill that silent, empty world.

And now Father began to speak, telling Marvin the story which until this moment had meant no more to him than the fairy tales he had once been told. There were many things he could not understand: it was impossible for him to picture the glowing, multicolored pattern of life on the planet he had never seen. Nor could he comprehend the forces that had destroyed it in the end, leaving the Colony, preserved by its isolation, as the sole survivor. Yet he could share the agony of those final days, when the Colony had learned at last that never again would the supply ships come flaming down through the stars with gifts from home. One by one the radio stations had ceased to call: on the shadowed globe the lights of the cities had dimmed and died, and they were alone at last, as no men had ever been alone before, carrying in their hands the future of the race.

Then had followed the years of despair, and the long-drawn battle for survival in this fierce and hostile world. That battle had been won, though barely: this little oasis of life was safe against the worst that Nature could do. But unless there was a goal, a future toward which it could work, the Colony would lose the will to live, and neither machines nor skill nor science could save it then.

So, at last, Marvin understood the purpose of this pilgrimage. He would never walk beside the rivers of that lost and legendary world, or listen to the thunder raging above its softly rounded hills. yet one day-how far ahead?-his children's children would return to claim their heritage. The winds and the rains would scour the poisons from the burning lands and carry them to the sea, and in the depths of the sea they would waste their venom until they could harm no living things. Then the great ships that were still waiting here, on the silent, dusty plains could lift once more into space, along the road that led to home.

That was the dream: and one day, Marvin knew with a sudden flash of insight, he would pass it on to his own son, here at this same spot with the mountains behind him and the silver light from the sky streaming into his face.

He did not look back as they began the homeward journey. He could not bear to see the cold glory of the crescent Earth fade from the rocks around him, as he went to rejoin his people in their long exile.

INHERITANCE

Arthur C. Clarke

As David said, when one falls on Africa from a height of two hundred and fifty kilometers, a broken ankle may be an anticlimax but it is none the less painful. But what hurt him most, he pretended, was the way we had all rushed out into the desert to see what had happened to the A.20 and hadn't come near him until hours later.

"Be logical, David," Jimmy Langford had protested. "We knew that you were O.K. because the base 'copter radioed when it picked you up. But the A.20 might have been a complete write-off."

"There's only one A.20," I said, trying to be helpful, "but rocket test-pilots are-well, if not two a penny, at any rate twelve for a dime."

David glared back at us from beneath his bushy eyebrows and said something in Welsh.

"The Druid's curse," Jimmy remarked to me. "Any moment now you'll turn into a leek or a perspex model of Stonehenge."

You see, we were still pretty light-headed and it wouldn't do to be serious for a while. Even David's iron nerve must have taken a terrific beating, yet somehow he seemed the calmest of us all. I couldn't understand it-then.

The A.20 had come down fifty kilometers from her launching point. We'd followed her by radar for the whole trajectory, so we knew her position to within a few meters-though we didn't know at the time that David had landed ten kilometers farther east.

The first warning of disaster had come seventy seconds after takeoff. The A.20 had reached fifty kilometers and was following the correct trajectory to within a few per cent. As far as the eye

could tell, the luminous track on the radar screen had scarcely deviated from the pre-computed path. David was doing two kilometers a second: not much, but the fastest any man had ever traveled up to then. And Goliath was just about to be jettisoned.

The A.20 was a two-step rocket. It had to be, for it was using chemical fuels. The upper component, with its tiny cabin, its folded acrofoils and flaps, weighed just under twenty tons when fully

fuelled. It was to be lifted by a lower two-hundred-ton booster -which would take it up to fifty kilometers, after which it could carry on quite happily under its own power. The big fellow would then drop back to Earth by parachute: it wouldn't weigh much when its fuel was burnt. Meanwhile the upper step would have built up enough speed to reach the six-hundred-kilometer level before falling back and going into a glide that would take David halfway round the world if he wished.

I don't remember who called the two rockets David and Goliath but the names caught on at once. Having two David's around caused a lot of confusion, not all of it accidental.

Well, that was the theory, but as we watched the tiny green spot on the screen fall away from its calculated course, we knew that something had gone wrong. And we guessed what it was.

At fifty kilometers the spot should have divided in two. The brighter echo should have continued to rise as a free projectile, and then fallen back to Earth. But the other should have gone on, still accelerating, drawing swiftly away from the discarded booster.

There had been no separation. The empty Goliath had refused to come free and was dragging David back to Earth-helplessly, for David's motors could not be used. Their exhausts were blocked by the machine beneath.

We saw all this in about ten seconds. We waited just long enough to calculate the new trajectory, and then we climbed into the copters and set off for the target area.

All we expected to find, of course, was a heap of magnesium looking as if a bulldozer had gone over it. We knew that Goliath couldn't eject its parachute while David was sitting on top of it, any more than David could use its motors while Goliath was clinging beneath. I remember wondering who was going to break the news to Mavis, and then realizing that she'd be listening to the radio and would know all about it as soon as anyone.

We could scarcely believe our eyes when we found the two rockets still coupled together, lying undamaged beneath the big parachute. There was no sign of David, but a few minutes later Base called to say that he'd been found. The plotters at Number Two Station had picked up the tiny echo from his parachute and sent a 'copter to collect him. He was in the hospital twenty minutes later, but we stayed out in the desert for several hours checking over the machines and making arrangements to retrieve them.

When at last we got back to Base, we were pleased to see our best-hated science-reporters among the mob being held at bay. We waved aside their protests and sailed on into the ward.

The shock and the subsequent relief had left us all feeling rather irresponsible and perhaps childish. Only David seemed unaffected: the fact that he'd just had one of the most miraculous escapes in human history hadn't made him turn a hair. He sat there in the bed pretending to be annoyed at our jibes until we'd calmed down.

"Well," said Jimmy at last, "what went wrong?"

"That's for you to discover," David replied. "Goliath went like a dream until fuel-cutoff point. I waited then for the five-second pause before the explosive bolts detonated and the springs threw it clear, but nothing happened. So I punched the emergency release. The lights dimmed, but the kick I'd expected never came. I tried a couple more times but somehow I knew it was useless. I guessed that something had shorted in the detonator circuit and was earthling the power supply.

"Well, I did some rather rapid calculations from the flight charts and abacs in the cabin. At my present speed I'd continue to rise for another two hundred kilometers and would reach the peak of my trajectory in about three minutes. Then I'd start the two-hundred and-fifty-kilometer fall and should make a nice hole in the desert four minutes later. All told, I seemed to have a good seven minutes of life left-ignoring air-resistance, to use your favorite phrase. That might add a couple of minutes to my expectation of life.

"I knew that I couldn't get the big parachute out, and David's wings would be useless with the forty-ton mass of Goliath on its tail. I'd used up two of my seven minutes before I decided what to do.

“It’s a good job I made you widen that airlock. Even so, it was

a sq,- v space-suit. I tied the end of the safety rope to a locking lever and crawled along the hull until I reached the junction of the two steps.

“The parachute compartment couldn’t be opened from the outside, but I’d taken the emergency axe from the pilot’s cabin. It didn’t take long to get through the magnesium skin: once it had been punctured I could almost tear it apart with my hands. A few seconds later I’d released the ‘chute. The silk floated aimlessly around me: I had expected some trace of air-resistance at this speed hut there wasn’t a sign of it. The canopy simply stayed where it was put. I could only hope that when we re-entered atmosphere it would spread itself without fouling the rocket.

“I thought I had a fairly good chance of getting away with it. The additional weight of David would increase the loading of the parachute by less than twenty per cent, but there was always the chance that the shrouds would chafe against the broken metal and be worn through before I could reach Earth. In addition the canopy would be distorted when it did open, owing to the unequal lengths of the cords. There was nothing I could do about that.

“When I’d finished, .1 looked about me for the first time. I couldn’t see very well, for perspiration bad misted over the glass of my suit. (Someone had better look into that: it can be dangerous.) I was still rising, though very slowly now. To the northeast

I could see the whole of Sicily and some of the Italian mainland: farther south I could follow the Libyan coast as far as Bengasi. Spread out beneath me was all the land over which Alexander and Montgomery and Rommel had fought when I was a boy. It seemed rather surprising that anyone had ever made such a fuss about it.

“I didn’t stay long: in three minutes I would be entering the atmosphere. I took a last look at the flaccid parachute, straightened some of the shrouds, and climbed back into the cabin. Then I jettisoned David’s fuel-first the oxygen, and then, as soon as it had had time to disperse, the alcohol.

“That three minutes seemed an awfully long time. I was just over twenty-five kilometers high when I heard the first sound. It Was a very high-pitched whistle, so faint that I could scarcely bear it. Glancing through the portholes, I saw that the parachute shrouds Were becoming taut and the canopy was beginning to billow above me. At the same time I felt weight returning and knew that the rocket was beginning to decelerate.

“The calculation wasn’t very encouraging. I’d fallen free for over two hundred kilometers and if I was to stop in time I’d need an average deceleration of ten gravities. The peaks might be twice that, but I’d stood fifteen g before now in a lesser cause. So I gave myself a double shot of dynocaine and uncaged the gimbals of my seat. I remember wondering whether I should let out David’s little wings, and decided that it wouldn’t help. Then I must have blacked out.

„When I came round again it was very hot, and I had normal weight. I felt very stiff and sore, and to make matters worse the cabin was oscillating violently. I struggled to the port and saw that the desert was uncomfortably close. The big parachute had done its work, but I thought that the impact was going to be rather too violent for comfort. So I jumped.

“From what you tell me I’d have done better to have stayed in the ship. But I don’t suppose I can grumble.”

We sat in silence for a while. Then Jimmy remarked casually:

"The accelerometer shows that you touched twenty-one gravities on the way down. Only for three seconds, though. Most of the time it was between twelve and fifteen."

David didn't seem to hear and presently I said:

"Well, we can't hold the reporters off much longer. Do you feel like seeing them?"

David hesitated.

"No," he answered. "Not now."

He read our faces and shook his head violently.

"No," he said with emphasis, "it's not that at all. I'd be willing to take off again right now. But I want to sit and think things over for a while."

His voice sank, and when he spoke again it was to show the real David behind the perpetual mask of extraversion.

"You think I haven't any nerves," he said, "and that I take risks without bothering about the consequences. Well, that isn't quite true and I'd like you to know why. I've never told anyone this, not even Mavis.

"You know I'm not superstitious," he began, a little apologetically, "but most materialists have some secret reservations, even if they won't admit them.

"Many years ago I had a peculiarly vivid dream. By itself, it

wouldn't have meant much, but later I discovered that two other men had put almost identical experiences on record. One you've probably read, for the man was J. W. Dunne.

"In his first book, An Experiment with Time, Dunne tells how

once dreamed that he was sitting at the controls of a curious flying machine with swept-back wings, and years later the whole experience came true when he was testing his inherent-stability aeroplane. Remembering my own dream, which I'd had before reading Dunne's book, this made a considerable impression on me. But the second incident I found even more striking.

"You've heard of Igor Sikorsky: he designed some of the first commercial long-distance flying-boats-'Clippers,' they were called. in his autobiography, The Story of the Winged-S, he tells us how he had a dream very similar to Dunne's.

"He was walking along a corridor with doors opening on either side and electric lights glowing overhead. There was a slight vibration underfoot and somehow he knew that he was in a flying machine. Yet at that time there were no aeroplanes in the world, and few people believed there ever would be.

"Sikorsky's dream, like Dunne's, came true many years later. He was on the maiden flight of his first Clipper when he found himself walking along that familiar corridor."

David laughed, a little self-consciously.

"You've probably guessed what my dream was about," he continued. "Remember, it would have made no permanent impression if I hadn't come across these parallel cases.

"I was in a small, bare room with no windows. There were two other men with me, and we were all wearing what I thought at the time were diving-suits. I had a curious control panel in front of me,

with a circular screen built into it. There was a picture on the screen, but it didn't mean anything to me and I can't recall it now, though I've tried many times since. All I remember is turning to the other two men and saying: 'Five minutes to go, boys'-though I'm not sure if those were the exact words. And then, of course, I woke up.

"That dream has haunted me ever since I became a test pilot. No -haunted isn't the right word. It's given me confidence that in the long run everything would be all right-at least until I'm in that cabin with those other two men. What happens after that I don't know. But now you understand why I felt quite safe when I brought

down the A.20, and when I crash-landed the A.15 off Pantelleria. "So now you know. You can laugh if you please: I sometimes do myself. But even if there's nothing in it, that dream's given my subconscious a boost that's been pretty useful."

We didn't laugh, and presently Jimmy said:

"Those other men-did you recognize them?"

David looked doubtful.

"I've never made up my mind," he answered. "Remember, they were wearing space-suits and I didn't see their faces clearly. But one of them looked rather like you, though he seemed a good deal older than you are now. I'm afraid you weren't there, Arthur. Sorry."

"I'm glad to hear it," I said. "As I've told you before, I'll have to stay behind to explain what went wrong. I'm quite content to wait until the passenger service starts."

Jimmy rose to his feet.

"O.K., David," he said, "I'll deal with the gang outside. Get some sleep now-with or without dreams. And by the way, the A.20 will be ready again in a week. I think she'll be the last of the chemical rockets: they say the atomic drive's nearly ready for us."

We never spoke of David's dream again, but I think it was often in our minds. Three months later he took the A.20 up to six hundred and eighty kilometers, a record which will never be broken by a machine of this type, because no one will ever build a chemical rocket again. David's uneventful landing in the Nile Valley marked the end of an epoch.

It was three years before the A.21 was ready. She looked very small compared with her giant predecessors, and it was hard to believe that she was the nearest thing to a spaceship man had yet built. This time the takeoff was from sea level, and the Atlas Mountains which had witnessed the start of our earlier shots were now merely the distant background to the scene.

By now both Jimmy and I had come to share David's belief in his own destiny. I remember Jimmy's parting words as the airlock closed.

"It won't be long now, David, before we build that three-man ship."

And I knew he was only half joking.

We saw the A-21 climb slowly into the sky in great, widening circles, unlike any rocket the world had ever known before. There was no need to worry about gravitational loss now that we had a built-in fuel supply, and David wasn't in a hurry. The machine was still traveling quite slowly when I lost sight of it and went into the plotting room.

When I got there the signal was just fading from the screen, and the detonation reached me a little later. And that was the end of David and his dreams.

The next I recall of that period is flying down the Conway Valley in Jimmy's 'copter, with Snowdon gleaming far away on our right. We had never been to David's home before and were not looking forward to this visit. But it was the least that we could do.

As the mountains drifted beneath us we talked about the suddenly darkened future and wondered what the next step would be. Apart from the shock of personal loss, we were beginning to realize how much of David's confidence we had come to share ourselves. And now that confidence had been shattered.

We wondered what Mavis would do, and discussed the boy's future. He must be fifteen now, though I hadn't seen him for several years and Jimmy had never met him at all. According to his father he was going to be an architect and already showed considerable promise.

Mavis was quite calm and collected, though she seemed much older than when I had last met her. For a while we talked about business matters and the disposal of David's estate. I'd never been an executor before, but tried to pretend that I knew all about it.

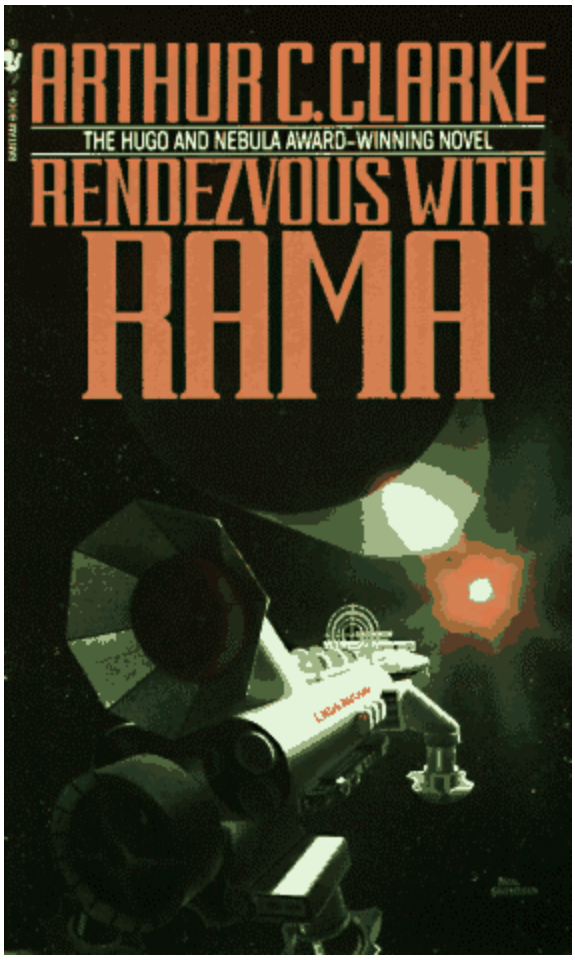
We had just started to discuss the boy when we beard the front door open and he came into the house. Mavis called to him and his footsteps came slowly along the passage. We could tell that he didn't want to meet us, and his eyes were still red when he entered the room.

I had forgotten how much like his father he was, and I heard a little gasp from Jimmy.

"Hello, David," I said.

But he didn't look at me. He was staring at Jimmy, with that Puzzled expression of a man who has seen someone before but can't remember where.

And quite suddenly I knew that young David would never be art architect.



Rendezvous with Rama by Arthur C Clarke

12 The Stairway of the Gods

13 The Plain of Rama

14 Storm Warning

15 The Edge of the Sea

16 Kealakekua

17 Spring

18 Dawn

19 A Warning from Mercury

20 Book of Revelation

21 After the Storm

22 To Sail the Cylindrical Sea

23 NY, Rama

24 Dragonfly

25 Maiden Flight

26 The Voice of Rama

27 Electric Wind

28 Icarus

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30 The Flower

31 Terminal Velocity

32 The Wave

33 Spider

34 His Excellency Regrets ...

35 Special Delivery

36 Biot Watcher

37 Missile

38 General Assembly

39 Command Decision

CHAPTER ONE - Spaceguard

Sooner or later, it was bound to happen. On 30 June 1908, Moscow escaped destruction by three hours and four thousand kilometres - a margin invisibly small by the standards of the universe. Again, on 12 February 1947, yet another Russian city had a still narrower escape, when the second great meteorite of the twentieth century detonated less than four hundred kilometres from Vladivostok, with an explosion rivalling that of the newly invented uranium bomb.

In those days, there was nothing that men could do to protect themselves against the last random shots in the cosmic bombardment that had once scarred the face of the Moon. The meteorites of 1908 and 1947 had struck uninhabited wilderness; but by the end of the twenty-first century, there was no region left on Earth that could be safely used for celestial target practice. The human race had spread from pole to pole. And so, inevitably.

At 09.46 GMT on the morning of 11 September, in the exceptionally beautiful summer of the year 2077, most of the inhabitants of Europe saw a dazzling fireball appear in the eastern sky. Within seconds it was brighter than the sun, and as it moved across the heavens - at first in utter silence - it left behind it a churning column of dust and smoke.

Somewhere above Austria it began to disintegrate, producing a series of concussions so violent that more than a million people had their hearing permanently damaged. They were the lucky ones.

Moving at fifty kilometres a second, a thousand tons of rock and metal impacted on the plains of northern Italy, destroying in a few flaming moments the labour of centuries. The cities of Padua and Verona were wiped from the face of the earth; and the last glories of Venice sank for ever beneath the sea as the waters of the Adriatic came -

thundering landwards after the hammer-blow from space.

Six hundred thousand people died, and the total dam age was more than a trillion dollars. But the loss to art, to history, to science - to the whole human race, for the rest of time - was beyond all computation. It was as if a great war had been fought and lost in a single morning; and few could draw much pleasure from the fact that, as the dust of destruction slowly settled, for months the whole world witnessed the most splendid dawns and sunsets since Krakatoa. -

After the initial shock, mankind reacted with a de- termination and a unity that no earlier age could have shown. Such a disaster, it was realized, might not occur again for a thousand years - but it might occur tomor- row. And the next time, the consequences could be even worse.

Very well; there would be no next time.

A hundred years earlier a much poorer world, with far feebler resources, had squandered its wealth attempting to destroy weapons launched, suicidally, by mankind against itself. The effort had never been successful, but the skills acquired then had not been forgotten. Now they could be used for a far nobler purpose, and on an infinitely vaster stage. No meteorite large enough to cause catastrophe would ever again be allowed to breach the defences of Earth.

So began Project SPACEGUARD. Fifty years later - and in a way that none of its designers could ever have an- ticipated - it justified its existence.

CHAPTER TWO - Intruder

By the year 2130, the Mars-based radars were discovering new asteroids at the rate of a dozen a day. The SPACE- GUARD computers automatically calculated their orbits, and stored away the information in their enormous mem- ories, so that every few months any interested astronomer could have a look at the accumulated statistics. These were now quite impressive.

It had taken more than a hundred and twenty years to collect the first thousand asteroids, since the discovery of Ceres, largest of these tiny worlds, on the very first day of the nineteenth century. Hundreds had been found and lost and found again; they existed in such swarms that one exasperated astronomer had christened them 'vermin of the skies'. He would have been appalled to know that SPACEGUARD was now keeping track of half a million.

Only the five giants - Ceres, Pallas, Juno, Eunomia and Vesta - were more than two hundred kilometres in dia- meter; the vast majority were merely oversized boulders

that would fit into a small park. Almost all moved in orbits that lay beyond Mars; only the few that came far enough sunwards to be a possible danger to Earth were the concern of SPACEGUARD. And not one in a thousand of these, during the entire future history of the solar system, would pass within a million kilometres of Earth.

The object first catalogued as 31/439, according to the year and the order of its discovery, was detected while still outside the orbit of Jupiter. There was nothing unusual about its location; many asteroids went beyond Saturn before turning once more towards their distant master, the sun. And Thule II, most far-ranging of all, travelled so close to Uranus that it might well have been a lost moon of that planet.

But a first radar contact at such a distance was unprecedented; clearly, 31/439 must be of exceptional size. From the strength of the echo, the computers deduced a diameter of at least forty kilometres; such a giant had not - been discovered for a hundred years. That it had been overlooked for so long seemed incredible.

Then the orbit was calculated, and the mystery was resolved - to be replaced by a greater one. 31/439 was not travelling on a normal asteroidal path, along an ellipse which it retraced with clockwork precision every few years. It was a lonely wanderer between the stars, making its first and last visit to the solar system - for it was moving so swiftly that the gravitational field of the sun could never capture it. It would flash inwards past the orbits of Jupiter, Mars, Earth, Venus and Mercury, gaining speed - as it did so, until it rounded the sun and headed out once again into the unknown.

It was at this point that the computers started flashing their 'Hi there! We have something interesting' sign, and for the first time 31/439 came to the attention of human beings. There was a brief flurry of excitement at SPACEGUARD Headquarters, and the interstellar vagabond was quickly dignified by a name instead of a mere number. Long ago, the astronomers had exhausted Greek and Roman mythology; now they were working through the Hindu pantheon. And so 31/439 was christened Rama.

For a few days, the news media made a fuss of the visitor, but they were badly handicapped by the sparsity of information. Only two facts were known about Rama - its unusual orbit, and its approximate size. Even this was merely an educated guess, based upon the strength of the radar echo. Through the telescope, Rama still appeared as a faint, fifteenth magnitude star - much too small to show a visible disc But as it plunged in towards the heart of the solar system, it would grow brighter and larger, month by month; before it vanished for ever, the orbiting observatories would be able to gather more pre-

cise information about its shape and size. There was plenty of time, and perhaps during the next 'few years some spaceship on its ordinary business might be routed close enough to get good photographs. An actual rendezvous was most unlikely; the energy cost would be far too great to permit physical contact with an object cutting across the orbits of the planets at more than a hundred thousand kilometres an hour.

So the world soon forgot about Rama; but the astronomers did not. Their excitement grew with the passing months, as the new asteroid presented them with more and more puzzles.

First of all, there was the problem of Rama's light curve. it didn't have one.

All known asteroids, without exception, showed a slow variation in their brilliance, waxing and waning within a period of a few hours. It had been recognized for more than two centuries that this was an inevitable result of their spin, and their irregular shape. As they toppled end over end along their orbits the reflecting surfaces they presented to the sun were continually changing, and their brightness varied accordingly.

Rama showed no such changes. Either it was not spinning at all or it was perfectly symmetrical. Both explanations seemed equally unlikely.

There the matter rested for several months, because none of the big orbiting telescopes could be spared from their regular job of peering into the remote depths of the universe. Space astronomy was an expensive hobby, and time on a large instrument could easily cost a thousand dollars a minute. Dr William Stenton would never have been able to grab the Farside two-hundred-metre reflector for a full quarter of an hour, if a more important programme had not been temporarily derailed by the failure of a fifty cent capacitor. One astronomer's bad luck was his good fortune.

Bill Stenton did not know what he had caught until the next day, when he was able to get computer time to process his results. Even when they were finally flashed on his display screen, it took him several minutes to understand what they meant.

The sunlight reflected from Rama was not, after all, absolutely constant in its intensity. There was a very small variation - hard to detect, but quite unmistakable, and extremely regular. Like all the other asteroids, Rama was indeed spinning. But whereas the normal 'day' for an asteroid was several hours, Rama's was only four minutes.

Dr Stenton did some quick calculations, and found it hard to believe the results. At its equator, this tiny world

must be spinning at more than a thousand kilometres an hour; it would be rather unhealthy to attempt a landing anywhere except at the poles. The centrifugal force at Rama's equator must be powerful enough to flick any loose objects away from it at an acceleration of almost one gravity. Rama was a rolling stone that could never have gathered any cosmic moss; it was surprising that such a body had managed to hold itself together, and- had not long ago shattered into a million fragments.

An object forty kilometres across, with a rotation period of only four minutes - where did that fit into the astronomical scheme of things? Dr Stenton was a somewhat imaginative man, a little too prone to jump to conclusions. He now jumped to one which gave him a very uncomfortable few minutes indeed.

The only specimen of the celestial zoo that fitted this description was a collapsed star. Perhaps Rama was a dead sun - a madly spinning sphere of neutronium, every cubic centimetre weighing billions of tons...

At this point, there flashed briefly through Dr Stenton's horrified mind the memory of that timeless classic, H. G. Wells's The Star. He had first read it as a very small boy, and it had helped to spark his interest in astronomy. Across more than two centuries of time, it had lost none of its magic and terror. He would never forget the images of hurricanes and tidal waves, of cities sliding into the sea, as that other visitor from the stars smashed into Jupiter and then fell sunwards past the Earth. True, the star that old Wells described was not cold, but incandescent, and wrought much of its destruction by heat. That scarcely mattered; even if Rama was a cold body, reflecting only the light of the sun, it could kill by gravity as easily as by fire.

Any stellar mass intruding into the solar system would completely distort the orbits of the planets. The Earth had only to move a few million kilometres sunwards - or starwards - for the delicate balance of climate to be destroyed. The Antarctic icecap could melt and flood all :low4ying land; or the oceans could freeze and the whole world be locked in an eternal winter. Just a nudge in either direction would be enough

Then Dr Stenton relaxed and breathed a sigh of relief. This was all nonsense; he should be ashamed of himself.

Rama could not possibly be made of condensed matter. No star-sized mass could penetrate so deeply into the solar system without producing disturbances which would have betrayed it long ago. The orbits of all the planets would have been affected; that, after all, was how Neptune, Pluto and Persephone had been discovered. No, it was utterly impossible for an object as massive as a dead sun to sneak up unobserved.

In a way, it was a pity. An encounter with a dark star would have been quite exciting.

While it lasted...

CHAPTER THREE - Rama and Sita

The extraordinary meeting of the Space Advisory Council was brief and stormy. Even in the twenty-second century, no way had yet been discovered of keeping elderly and conservative scientists from occupying crucial administrative positions. Indeed, it was doubted if the problem ever would be solved.

To make matters worse, the current Chairman of the SAC was Professor (Emeritus) Olaf Davidson, the distinguished astrophysicist. Professor Davidson was not very much interested in objects smaller than galaxies, and never bothered to conceal his prejudices. And though he had to admit that ninety per cent of his science was now based upon observations from space-borne instruments, he was not at all happy about it. No less than three times during his distinguished career, satellites specially launched to prove one of his pet theories had done precisely the opposite.

The question before the Council was straightforward enough. There was no doubt that Rama was an unusual object - but was it an important one? In a few months it would be gone for ever, so there was little time in which to act. Opportunities missed now would never recur.

At rather a horrifying cost, a space-probe soon to be launched from Mars to beyond Neptune could be modified and sent on a high-speed trajectory to meet Rama. There was no hope of a rendezvous; it would be the fastest fly-by on record, for the two bodies would pass each other at two hundred thousand kilometres an hour. Rama would be observed intensively for only a few minutes - and in real closeup for less than a second. But with the right instrumentation, that would be long enough to settle many questions.

Although Professor Davidson took a very jaundiced view of the Neptune probe, it had already been approved and he saw no point in sending more good money after bad. He spoke eloquently on the follies of asteroid-chasing, and the urgent need for a new high-resolution interferometer on the Moon to prove the newly-revived Big Bang theory of creation, once and for all. -

That was a grave tactical error, because the three most ardent supporters of the Modified Steady State Theory were also members of the Council. They secretly agreed with Professor Davidson that asteroid-chasing was a waste of money; nevertheless...

He lost by one vote.

Three months later the space-probe, rechristened Sita, was launched from Phobos, the inner moon of Mars. The flight time was seven weeks, and the instrument was switched to full power only five minutes before interception. Simultaneously, a cluster of camera pods was released, to sail past Rama so that it could be photographed from all sides.

The first images, from ten thousand kilometres away, brought to a halt the activities of all mankind. On a bib lion television screens, there appeared a tiny, featureless cylinder, growing rapidly second by second. By the time it had doubled its size, no one could pretend any longer that Rama was a natural object.

Its body was a cylinder so geometrically perfect that it might have been turned on a lathe - one with centres fifty kilometres apart. The two ends were quite flat, apart from some small structures at the centre of one face, and were twenty kilometres across; from a distance, when there was no sense of scale, Rama looked almost comically like an ordinary domestic boiler.

Rama grew until it filled the screen. Its surface was a dull, drab grey, as colourless as the Moon, and completely devoid of markings except at one point. Halfway along the cylinder there was a kilometre-wide stain or smear, as if something had once hit and splattered, ages ago.

There was no sign that the impact had done the slightest damage to Rama's spinning walls; but this mark had produced the slight fluctuation in brightness that had led to Stenton's discovery.

The images from the other cameras added nothing new. However, the trajectories their pods traced .through Rama's minute gravitational field gave one other vital piece of information - the mass of the cylinder.

It was far too light to be a solid body. To nobody's great surprise, it was clear that Rama must be hollow.

The long-hoped-for, long-feared encounter had come at last. Mankind was about to receive its first visitor from the stars.

CHAPTER FOUR - Rendezvous

Commander Norton remembered those first TV transmissions, which he had replayed so many times, during the final minutes of the rendezvous. But there was one thing no electronic image could possibly convey - and that was Rama's overwhelming size.

He had never received such an impression when landing on a natural body like the Moon or Mars. Those were worlds, and one expected them to be big. Yet he had also landed on Jupiter VIII, which was slightly larger than Rama - and that had seemed quite a small object.

It was very easy to resolve the paradox. His judgement was wholly altered by the fact that this was an artifact, millions of times heavier than anything that Man had ever put into space. The mass of Rama was at least ten million million tons; to any spaceman, that was not only an awe-inspiring, but a terrifying thought. No wonder that he sometimes felt a sense of insignificance, and even depression, as that cylinder of sculptured, ageless metal filled more and more of the sky.

There was also a sense of danger here, that was wholly novel to his experience. In every earlier landing he had known what to expect; there was always the possibility of accident, but never of surprise. With Rama, surprise was the only certainty.

Now Endeavour was hovering less than a thousand metres above the North Pole of the cylinder, at the very centre of the slowly turning disc. This end has been chosen because it was the one in sunlight; as Rama rotated, the shadows of the short enigmatic structures near the axis swept steadily across the metal plain. The northern face of Rama was a gigantic sundial, measuring out the swift passage of its four-minute day.

Landing a five-thousand-ton spaceship at the centre of a spinning disc was the least of Commander Norton's worries. It was no different from docking at the axis of a large space-station; Endeavour's lateral jets had - already given her a matching spin, and he could trust Lieutenant Joe Calvert to put her down as gently as a snowflake, with or without the aid of the nay computer.

'In three minutes,' said Joe, without taking his eyes from the display, 'we'll know if it's made of anti-matter.'

Norton grinned, as he recalled some of the more hair-raising theories about Rama's origin. If that unlikely speculation was true, in a few seconds there would be the biggest bang since the solar system was formed. The total annihilation of ten thousand tons would, briefly, provide the planets with a second sun. -

Yet the mission profile had allowed even for this remote contingency; Endeavour had squirted Rama with one of her jets from a safe thousand kilometres away. Nothing whatsoever had happened when the expanding cloud of vapour arrived on target - and a matter-anti-matter reaction involving even a few milligrams would have produced an awesome firework display.

Norton, like all space commanders, was a cautious man. He had looked long and hard at the northern face of Rama, choosing the point of touchdown. After much thought, he had decided to avoid the obvious spot - the exact centre, on the axis itself. A clearly marked circular disc, a hundred metres in diameter, was centred on the Pole, and Norton had a strong suspicion that this must be the outer seal of an enormous airlock. The creatures who had built this hollow world must have had some way of taking' their ships inside. This was the logical place for the main entrance, and Norton thought it might be UN-wise to block the front door with his own vessel.

But this decision generated other problems. If Endive-our touched down even a few metres from the axis, Rama's rapid spin would start her sliding away from the pole. At first, the centrifugal force would be very weak, but it would be continuous and inexorable. Com-mannered Norton did not relish the thought of 'his ship slithering across the polar plain, gaining speed minute by minute until it was slung off into space at a thou-sand kilometres an hour when it reached the edge of the disc.

It was possible that Rama's minute gravitational field - about one thousandth of Earth's - might prevent this from happening. It would hold Endeavour against the plain with a force of several tons, and if the surface was sufficiently rough the ship might stay near the Pole. But Commander Norton had no intention of balancing an UN-known frictional force against a quite certain centrifugal one.

Fortunately, Rama's designers had provided an answer. Equally spaced around the polar axis were three low, pill-box shaped structures, about ten metres in diameter. If Endeavour touched down between any two of these, the centrifugal drift would fetch her up against them and she would be held firmly in place, like a ship glued against a quayside by the incoming waves.

'Contact in fifteen seconds,' said Joe. As he tensed him-self. above the duplicate controls, which he hoped he would not have to touch, Commander Norton became acutely aware of all that had come to focus on this instant of time. This, surely, was the most momentous landing since the first touchdown on the Moon, a century and a half ago.

The grey pill-boxes drifted slowly upwards outside the control port. There was the last hiss of a reaction jet, and a barely perceptible jar.

In the weeks that had passed, Commander Norton had often wondered what he would say at this moment. But now that it was upon him, History chose his words, and he spoke almost automatically, barely aware of the echo

from the past:

'Rama Base. Endeavour has landed.'
As recently as a month ago, he would never have believed it possible. The ship had been on a routine mission, checking and emplacing asteroid warning beacons, when the order had come. Endeavour was the only spacecraft in the solar system which could possibly make a rendezvous with the intruder before it whipped round the sun and hurled itself back towards the stars. Even so, it had been necessary to rob three other ships of the Solar Survey, which were now drifting helplessly until tankers could refuel them. Norton feared that it would be a long time before the skippers of Calypso, Beagle and Challenger would speak to him again.

Even with all this extra propellant, it had been a long hard chase; Rama was already inside the orbit of Venus when Endeavour caught up with her. No other ship could ever do so; this -privilege was unique, and not a moment of the weeks ahead was to be wasted. A thousand scientists on Earth would have cheerfully mortgaged their souls for this opportunity; now they could only watch over the TV circuits, biting their lips and thinking how much better they could do the job. They were probably fight, but there was no alternative. The inexorable laws of celestial mechanics had decreed that Endeavour was the first, and the last, of all Man's ships that would ever make contact with Rama.

The advice he was continually receiving from Earth did little to alleviate Norton's responsibility. If split-second decisions had to be made, no one could help him; the radio time-lag to Mission Control was already ten minutes, and increasing. He often envied the great navigators of the past, before the days of electronic communications, who could interpret their sealed orders without continual monitoring from headquarters. Why they made mistakes, no one ever knew.

Yet at the same time, he was glad that some decisions could be delegated to Earth. Now that Endeavour's orbit had coalesced with Rama's they were heading sunwards like a single body; in forty days they would reach perihelion, and pass within twenty million kilometres of the sun. That was far too close for comfort; long before then, Endeavour would have to use her remaining fuel to nudge herself into a safer orbit. They would have perhaps three weeks of exploring time, before they - parted from Rama for ever.

After that, the problem would be Earth's. Endeavour would be virtually helpless, speeding on an orbit which could make her the first ship to reach the stars - in approximately fifty thousand years. There was no need to worry, Mission Control had promised. Somehow, regardless of cost, Endeavour would be refuelled - even if it

proved necessary to send tankers after her, and abandon them in space once they had transferred every gramme of propellant. Rama was a prize worth any risk, short of a suicide mission.

And, of course, it might even come to that. Commander Norton had no illusions on this score. For the first time in a hundred years an element of total uncertainty had entered human affairs. Uncertainty was one thing that neither scientists nor politicians could tolerate. If that was the price of resolving it, Endeavour and her crew would be expendable.

CHAPTER FIVE - First EVA

Rama was as silent as a tomb - which, perhaps, it was. No radio signals, on any frequency; no vibrations that the seismographs could pick up, apart from the micro-tremors undoubtedly caused by the sun's increasing heat; no electrical currents; no radioactivity. It was almost ominously quiet; one might have expected that even an asteroid would be noisier.

What did we expect? Norton asked himself. A committee of welcome? He was not sure whether to be disappointed or relieved. The initiative, at any rate, ap peared up to him.

His orders were to wait for twenty-four hours, then to go out and explore. Nobody slept much that first day; even the crew members not on duty spent their time monitoring the ineffectually probing instruments, or simply looking out of the observation ports at the starkly geometrical landscape. Is this world alive? they asked themselves, over and over again. Is it dead? Or is it merely sleeping?

On the first EVA, Norton took only one companion - Lieut-Commander Karl Mercer, his tough and resourceful life-support officer. He had no intention of getting out of sight of the ship, and if there was any trouble, it was unlikely that a larger party would be safe. As a precaution, however, he had two more crew members, already suited up, standing by in the airlock.

The few grammes of weight that Rama's combined gravitational and centrifugal fields gave them were neither help nor hindrance; they had to rely entirely on their jets. As soon as possible, Norton told himself, he would string a cat's-cradle of guide ropes between the ship and the pill-boxes, so that they could move around without wasting propellants.

The nearest pill-box was only ten metres from the airlock, and Norton's first concern was to check that the contact had caused no damage to the ship. Endeavour's hull was resting against the curving wall with a thrust of see-

real tons, but the pressure was evenly distributed. Reassured, he began to drift around the circular structure, trying to determine its purpose.

Norton had travelled only a few metres when he came across an interruption in the smooth, apparently metallic wall. At first, he thought it was some peculiar decoration, for it seemed to serve no useful function. Six radial grooves, or slots, were deeply recessed in the metal, and lying in them were six crossed bars like the spokes of a rimless wheel, with a small hub at the centre. But there was no way in which the wheel could be turned, as it was embedded in the wall.

Then he noticed, with growing excitement, that there were deeper recesses at the ends of the spokes, nicely shaped to accept a clutching hand (claw? tentacle?). If one stood so, bracing against the wall, and pulled on the spoke so...

Smooth as silk, the wheel slid out of the wall. To his utter astonishment - for he had been virtually certain that any moving parts would have become vacuum-welded ages ago - Norton found himself holding a spoked wheel. He might have been the captain of some old windjammer standing at the helm of his ship.
He was glad that his helmet sunshade did not allow Mercer to read his expression.

He was startled, but also angry with himself; perhaps he had already made his first mistake. Were alarms now sounding inside Rama, and had his thoughtless action already triggered some implacable mechanism?

But Endeavour reported no change; its sensors still detected nothing but faint thermal crepitations and his own movements.

'Well, Skipper - are you going to turn it?'

Norton thought once more of his instructions. 'Use your own discretion, but proceed with caution.' If he checked every single move with Mission Control, he would never get anywhere.

'What's your diagnosis, Karl?' he asked Mercer. 'It's obviously a- manual control for an airlock - probably an emergency back-up system in case of power failure. I can't imagine any technology, however advanced, that wouldn't take such precautions.'

'And it would be fail-safe,' Norton told himself. 'It could only be operated if there was no possible danger to the system...'

He grasped two opposing spokes of the windlass, braced his feet against the ground, and tested the wheel.

It did not budge.

'Give me a hand,' he asked Mercer. Each took a spoke; exerting their utmost strength, they were unable to produce the slightest movement.

Of course, there was no reason to suppose that clocks and corkscrews on Rama turned in the same direction as they did on Earth... -

'Let's try the other way,' suggested Mercer.
This time, there was no resistance. The wheel rotated almost effortlessly through a full circle. Then, very smoothly, it took up the load.

Half a metre away, the curving wall of the pill-box started to move, like a slowly opening clamshell. A few particles of dust, driven by wisps of escaping air, streamed outwards like dazzling diamonds as the brilliant sunlight caught them.

The road to Rama lay open.

CHAPTER SIX - Committee

It had been a serious mistake, Dr Bose often thought, to put the United Planets Headquarters on the Moon. Inevitably, Earth tended to dominate the proceedings - as it dominated the landscape beyond the dome. If they had to build here, perhaps they should have gone to the Farside, where that hypnotic disc never shed its rays... But, of course, it was much too late to change, and in any case there was no real alternative. Whether the colonies liked it or not, Earth would be the cultural and economic overlord of the solar system for centuries to come.

Dr Bose had been born on Earth, and had not emigrated to Mars until he was thirty, so he felt that he could view the political situation fairly dispassionately. He knew now that he would never return to his home planet, even though it was only five hours away by shuttle. At 115, he was in perfect health, but he could not face the reconditioning needed to accustom him to three times the gravity he had enjoyed for most of his life. He was exiled for ever from the world of his birth; not being a sentimental man, this -had never depressed him unduly.

What did depress him sometimes was the need for dealing, year after year, with the same familiar faces. The marvels of medicine were all very well, and certainly he had no desire to put back the clock - but there were men around this conference table with whom he had worked for more than half a century. He knew exactly what they would say and how they would vote on any given subject. He wished that, some day, one of them would do something totally unexpected - even something quite crazy.

And probably they felt exactly the same way about him...

The Rama Committee was still manageably small, though doubtless that would soon be rectified. His six colleagues - the UP representatives for Mercury, Earth, Luna, Ganymede, Titan and Triton - were all present in the flesh. They had to be; electronic diplomacy was not possible over solar system distances. Some elder statesmen, accustomed to the instantaneous communications which Earth had long taken for granted, had never reconciled themselves to the fact that radio waves took minutes, or even hours, to journey across the gulfs between the planets. 'Can't you scientists do something about it?' they had been heard to complain bitterly, when told that face-to-face conversation was impossible between Earth and any of its remoter children. Only the Moon had that barely acceptable one-and-a-half-second delay - with all the political and psychological consequences which it implied. Because of this fact of astronomical life, the Moon - and only the Moon - would always be a suburb of Earth.

Also present in person were three of the specialists who had been co-opted to the Committee. Professor Davidson, the astronomer, was an old acquaintance; today, he did not seem his usual irascible self. Dr Bose knew nothing of the infighting that had preceded the launch of the first probe to Rama, but the Professor's colleagues had not let him forget it.

Dr Thelma Price was familiar through her numerous television appearances, though she had first made her reputation fifty years ago during the archaeological explosion that had followed the draining of that vast marine museum, the Mediterranean.

Dr Bose could still recall the excitement of that time, when the lost treasures of the Greeks, Romans and a dozen other civilizations were restored to the light of day. That was one of the few occasions when he was sorry to be living on Mars.

The exobiologist, Carlisle Perera, was another obvious choice; so was Dennis Solomons, the science historian. Dr Bose was slightly less happy about the presence of Conrad Taylor, the celebrated anthropologist, who bad made his reputation by uniquely combining scholarship and eroticism in his study of puberty rites in late twentieth-century Beverley Hills.

No one, however, could possibly have disputed the right of Sir Lewis Sands to be on the Committee. A man whose knowledge was matched only by his urbanity, Sir Lewis was reputed to lose his composure only when called the Arnold Toynbee of his age.

The great historian was not present in person; he stubbornly refused to leave Earth, even for so momentous a meeting as this. His stereo image, indistinguishable from reality, apparently occupied the chair to Dr Bose's right; as if to complete the illusion, someone had placed a glass of water in front of him. Dr Bose considered that this sort of technological tour de force was an unnecessary gimmick, but it was surprising how many undeniably great men were childishly delighted to be in two places at once. Sometimes this electronic miracle produced comic disasters; he had been at one diplomatic reception where somebody had tried to walk through a stereogram - and discovered, too late, that it was the real person. And it was even funnier to watch projections trying to shake hands...

His Excellency the Ambassador for Mars to the United Planets called his wandering thoughts to order, cleared his throat, and said: 'Gentlemen, the Committee is now in session. I think I am correct in saying that this is a gathering of unique talents, assembled to deal with a unique situation. The directive that the Secretary-General has given us is to evaluate that situation, and to advise Commander Norton when necessary.

This was a miracle of over-simplification, and everyone knew it. Unless there was a real emergency, the Committee might never be in direct contact with Commander Norton - if, indeed, he ever heard of its existence. For the Committee was a temporary creation of the United Planets' Science Organization, reporting through its Director to the Secretary-General. It was true that the Space Survey was part of the UP - but on the Operations, not the Science side. In theory, this should not make much difference; there was no reason why the Rama Committee - or anyone else for that matter - should not call up Commander Norton and offer helpful advice.

But Deep Space Communications are expensive. Endeavour could be contacted only through PLANETCOM, which was an autonomous corporation, famous for the strictness and efficiency of its accounting. It took a long time to establish a line of credit with PLANETCOM; somewhere, someone was working on this; but at the moment, PLANETCOM's hard-hearted computers did not recognize the existence of the Rama Committee.

'This Commander Norton,' said Sir Robert Mackay, the Ambassador for Earth. 'He has a tremendous responsibility. What sort of person is he?'

'I can answer that,' said Professor Davidson, his fingers flying over the keyboard of his memory pad. He frowned at the screenful of information, and started to make an instant synopsis.

'William Tsien Norton, Born 2077, Brisbane, Oceana. Educated Sydney, Bombay, Houston. Then five years at Astrograd, specializing in propulsion. Commissioned 2102. Rose through usual ranks - Lieutenant on the Third Persephone expedition, distinguished himself during fifteenth attempt to establish base on Venus ... um um - . . exemplary record . . . dual citizenship, Earth and Mars ... wife and one child in Brisbane, wife and two in Port Lowell, with option on third...'

'Wife?' asked Taylor innocently.

'No, child of course,' snapped the Professor, before he caught the grin on the other's face. Mild laughter rippled round the table, though the overcrowded terrestrials looked more envious than amused. After a century of determined effort, Earth had still failed to get its population below the target of one billion ...

.... appointed commanding officer Solar Survey Research Vessel Endeavour. First voyage to retrograde satellites of Jupiter ... um, that was a tricky one.., on asteroid mission when ordered to prepare for this operation ... managed to beat deadline...'

The Professor cleared the display and looked up at his colleagues.

'I think we were extremely lucky, considering that he was the only man available at such short notice. We might have had the usual run-of-the-mill captain.' He sounded as if be was referring to the typical peg-legged scourge of the spaceways, pistol in one hand and cutlass in the other.

'The record--only proves that he's competent,' objected the Ambassador from Mercury (population: i 12,500 but growing). 'How will be react in a wholly novel situation like this?'

On Earth, Sir Lewis Sands cleared his throat. A second and a half later, he did so on the Moon.

'Not exactly a novel situation,' he reminded the Hermian, 'even though it's three centuries since it last occurred. If Rama is dead, or unoccupied - and so far all the evidence suggests that it is - Norton is in the position of an archaeologist discovering the ruins of an extinct culture.' He bowed politely to Dr Price, who nodded in agreement. 'Obvious examples are Scbliemann at Troy or Mouhot at Angkor Vat. The danger is minimal, though of course accident can never be completely ruled out.'

'But what about the booby-traps and trigger mechanisms these Pandora people have been talking about?' asked Dr Price.

'Pandora?' asked the Hermian Ambassador quickly. 'What's that?'

'It's a crackpot movement,' explained Sir Robert, with as much embarrassment as a diplomat was ever likely to show, 'which is convinced that Rama is a grave potential danger. A box that shouldn't be opened, you know.' He doubted if the Hermian did know: classical studies were not encouraged on Mercury.

'Pandora - paranoia,' snorted Conrad Taylor. 'Oh, of course, such things are conceivable, but why should any intelligent race want to play childish tricks?'

'Well, even ruling out such unpleasantness,' Sir Robert continued, 'we still have the much more ominous possibility of an active, inhabited Rama. Then the situation is one of an encounter between two cultures - at very different technological levels. Pizzaro and the Incas. Peary and the Japanese. Europe and Africa. Almost invariably, the consequences have been disastrous - for one or both parties. I'm not making any recommendations: I'm merely pointing out precedents.'

'Thank you, Sir Robert,' replied Dr Bose. It was a mild nuisance, he thought, having two 'Sirs' on one small committee; in these latter days, knighthood was an honour which few Englishmen escaped. 'I'm sure we've all thought of these alarming possibilities. But if the creatures inside Rama are - er - malevolent - will it really make the slightest difference what we do?'

'They might ignore us if we go away.'

'What - after they've travelled billions of miles and thousands of years?'

The argument had reached the take-off point, and was now self-sustaining. Dr Bose sat back in his chair, said very little, and waited for the consensus to emerge.

It was just as he had predicted. Everyone agreed that, once he had opened the first door, it was inconceivable that Commander Norton should not open the second.

CHAPTER SEVEN - Two Wives

If his wives ever compared his videograms, Commander Norton thought with more amusement than concern, it would involve him in a lot of extra work. Now, he could make one long 'gram and dupe it, adding only brief- personal messages and endearments before shooting the almost identical copies off to Mars and Earth.

Of course, it was highly unlikely that his wives ever would do such a thing; even at the concessionary rates allowed to spacemen's families, it would be expensive.

And there would be no point in it; his families were on excellent terms with each other, and exchanged- the usual greetings on birthdays and anniversaries. Yet, on -the whole, perhaps it was just as well that the girls had never met, and probably never would. Myrna had been born on Mars and so could not- tolerate the high gravity of Earth. And Caroline hated even the twenty-five minutes of the longest possible terrestrial journey.

'Sorry I'm a day late with this transmission,' said the Commander after he had finished the general-purpose preliminaries, 'but I've been away from the ship for the last thirty hours, believe it or not. . . -

'Don't be alarmed - everything is under control, going perfectly. It's taken us two days, but we're almost through the airlock complex. We could have done it in a couple of hours, if we'd known what we do now. But we took no chances, sent remote cameras ahead, and cycled all the locks a dozen times to make sure they wouldn't seize up behind us - after we'd gone through...

'Each lock is a simple revolving cylinder with a slot on one side. You go in through this opening, crank the cyl-inder round a hundred and eighty degrees - and the slot then matches up with another door so that you can step out of it. Or float, in this case.

'The Ramans really made sure of things. There are three of these cylinder-locks, one after the other just in-side the outer hull and below the entry pill-box. I can't imagine how even one would fail, unless someone blew it up with explosives, but if it did, there would be a second back-up, and then a third...

'And that's only the beginning. The final lock opens into a straight corridor, almost half a kilometre long. It looks clean and tidy, like everything else we've seen; - every few metres there are small ports that probably held lights, but -now everything is completely black and, I don't mind telling you, scary. There are also two parallel slots, about a centimetre wide, cut in the walls and run-ning the whole length of the tunnel. We suspect that some kind of shuttle runs inside these, to tow equipment - or people - back and forth. It would save us a lot of trouble if we could get it working...

'I mentioned that the tunnel was half a kilometre long. Well, from our seismic soundings we knew that's about the thickness of the shell, so obviously we were almost through it. And at the end of the tunnel we were'nt sur-prised to find another of those cylindrical airlocks.

'Yes, and another. And another. These people seem to have done everything in threes. We're in the final lock chamber now, awaiting the OK from Earth before we go through. The interior of Rama is only a few metres away.

I'll be a lot happier when the suspense is over.

'You know Jerry Kirchoff, my Exec, who's got such a library of real books that he can't afford to emigrate from Earth? Well, Jerry told me about a situation just like this, back at the beginning of the twenty-first - no, twentieth century. An archaeologist found the tomb of an Egyptian king, the first one that hadn't been looted by robbers. His workmen took months to dig their way in, chamber by - chamber, until they came to the final wall. Then they broke through the masonery, and he held out a lantern and pushed his head inside. He found himself looking into a whole roomful of treasure - incredible stuff gold and jewels ...

'Perhaps this place is also a tomb; it seems more and more -likely. Even now, there's still not the slightest sound, or hint of any activity. Well, tomorrow we should know.'

Commander Norton switched the record to HOLD. What else, he wondered, should he say about the work before he began 'the separate personal messages to his families? Normally, he never went into so much detail, but these circumstances were scarcely normal. This might be the last 'gram he would ever send to those he loved; he owed it to them to explain what he was doing.

By the time they saw these images, and heard these words, he would be inside Rama - for better or for worse.

CHAPTER EIGHT - Through the Hub

Never before had Norton felt so strongly his kinship with that long dead Egyptologist. Not since Howard Carter had first peered into the tomb of Tutankhamen could any man have known a moment such as this - yet the comparison was almost laughably ludicrous.

Tutankhamen had been buried only yesterday - not even four thousand years ago; Rama might be older than mankind. That little tomb in the Valley of the Kings could have been lost in the corridors through which they had already passed, yet the space that lay beyond this final seal was at least a million times greater. And as for the treasure it might hold - that was beyond imagination.

No one had spoken over the radio circuits for at least five minutes; the well-trained team had not even reported verbally when all the checks were complete. Mercer had simply given him the OK sign and waved him towards the open tunnel. It was as if everyone realized that this was a moment for History, not to be spoiled by unnecessary small-talk. That suited Commander Norton, for at the moment he too had nothing to say. He flicked on the beam of his flashlight, triggered his jets,

and drifted slowly down the short corridor, trailing his safety line behind him. Only seconds later, he was inside.

Inside what? All before him was total darkness; not a glimmer of light was reflected back from the beam. He bad expected this, but he had not really believed it. All the calculations had shown that the far wail was tens of kilometres away; now his eyes told him that this was indeed the truth. As he drifted slowly into that darkness, he felt a sudden need for the reassurance of his safety line, stronger than any he had ever experienced before, even on his very first EVA. And that was ridiculous; he had looked out across the light-years and the megaparsecs without vertigo; why should he be disturbed by a few cubic kilometres of emptiness?

He was still queasily brooding over this problem when the momentum damper at the end of the line braked him gently to a halt, with a barely perceptible rebound. He swept the vainly-probing beam of the flashlight down from the nothingness ahead, to examine the surface from which he had emerged.

He might have been hovering over the centre of a small crater, which was itself a dimple in the base of a much larger one. On either side rose a complex of terraces and ramps - all geometrically precise and obviously artificial - which extended for as far as the beam could reach. About a hundred metres away he could see the exit of the other two airlock systems, identical with this one.

And that was all. There was nothing particularly exotic or alien about the scene: in fact, it bore a considerable resemblance to an abandoned mine. Norton felt a vague sense of disappointment; after all this effort, there should have been some dramatic, even transcendental revelation. Then he reminded himself that he could see only a couple of hundred metres. The darkness beyond his field of view might yet contain more wonders than he cared to face.

He reported briefly to his anxiously-waiting companions, then added: 'I'm sending out the flare - two minutes delay. Here goes.' -

With all his strength, he threw the little cylinder straight upwards - or outwards - and started to count seconds as it dwindled along the beam. Before he had reached the quarter minute it was out of sight; when he had got to a hundred be shielded his eyes and aimed the camera. He had always been good at estimating time; ht was only two seconds off when the world exploded with light. And this time there was no cause for disappointment.

Even the millions of candlepower of the flare could not light up the whole of this enormous cavity, but now he

could see enough to grasp its plan and appreciate its titanic scale. He was at one end of a hollow cylinder at least ten kilometres wide, and of indefinite length. From his viewpoint at the central axis he could see such a mass of detail on the curving walls surrounding him that his mind could not absorb more than a minute fraction of it.; he was looking at the landscape of an entire world by a single flash of lightning, and he tried by a deliberate effort of will to freeze the image in his mind.

All round him, the terraced slopes of the 'crater' rose up until they merged into the solid 'wall that rimmed the sky. No - that impression was false; he must discard the instincts both of earth and of space, and reorientate himself to a new system of coordinates.

He was not at the lowest point of this strange, inside-out world, but the highest. From here, all directions were down, not up. If he moved away from this central axis, towards the curving wall which he must no longer think of as a wall, gravity would steadily increase. When he reached the inside surface of the cylinder, he could stand upright on it at any point, feet towards the stars and head towards the centre of the spinning drum. The concept was familiar enough; since the earliest dawn of spaceflight, centrifugal force had been used to simulate gravity. It was only the scale of this application which was so overwhelming, so shocking. The largest of all space-stations, Syncsat Five, was less than two hundred metres in diameter. It would take some little while to grow accustomed to one a hundred times that size.

The tube of landscape which enclosed him was mottled with areas of light and shade that could have been forests, fields, frozen lakes or towns; the distance, and the fading illumination of the flare, made identification impossible. Narrow lines that could be highways, canals, or well-trained rivers formed a faintly visible geometrical network; and far along the cylinder, at the very limit of vision, was a band of deeper darkness. It formed a complete circle, ringing the interior of this world, and Norton suddenly recalled the myth of Oceanus, the sea which, the ancients believed, surrounded the Earth.

Here, perhaps, was an even stranger sea - not circular, but cylindrical. Before it became frozen in the inter- - stellar night, did it have waves and tides and currents - and fish?

The flare guttered and died; the moment of revelation was over. But Norton knew that as long as he lived these images would be burned on his mind. Whatever discoveries the future might bring, they could never erase this first impression. And History could never take from him the privilege of being the first of all mankind to gaze upon the works of an alien civilization.

CHAPTER NINE - Reconnaissance

'We have now launched five long-delay flares down the axis of the cylinder, and so have a good photo-coverage of its full length. All the main features are mapped; though there are very few that we can identify, we've given them provisional names.

'The interior cavity is fifty kilometres long and sixteen wide. The two ends are bowl-shaped, with rather complicated geometries. We've called ours the Northern Hemisphere and are establishing our first base here at the axis.

'Radiating away from the central hub, 120 degrees apart, are three ladders that are almost a kilometre long. They all end at a terrace or ring-shaped plateau, that runs right round the bowl. And leading on from that, continuing the direction of the ladders, are three enormous stairways, which go all the way down to the plain. If you imagine an umbrella with only three ribs, equally spaced, you'll have a good idea of this end of Rama.

'Each of those ribs is a stairway, very steep near the axis and then slowly flattening out as it approaches the plain below. The stairways - we've called them Alpha, Beta, Gamma - aren't continuous, but break at five more circular terraces. We estimate there must be between twenty and thirty thousand steps . . . presumably they were only used for emergencies, since it's inconceivable that the Ramans - or whatever we're going to call them - had no better way of reaching the axis of their world.

'The Southern Hemisphere looks quite different; for one thing, it has no stairways, and no flat central hub. Instead, there's a huge spike - kilometres long - jutting along the axis, with six smaller ones around it. The whole arrangement is very odd, and we can't imagine what it means.

'The fifty-kilometre-long cylindrical section between the two bowls we've called the Central Plain. It may seem crazy to use the word "plain" to describe something so obviously curved, but we feel it's justified. It will appear flat to us when we get down there - just as the interior of a bottle must seem flat to an ant crawling round inside it.

'The most striking feature of the Central Plain is the ten-kilometre-wide dark band running completely round it at the half-way mark. It looks like ice, so we've christened it the Cylindrical Sea. Right out in the middle there's a large oval island, about ten kilometres long and three wide, and covered with tall structures. Because it reminds us of Old Manhattan, we've called it New York. Yet I don't think it's a city; it seems more like an enormous factory or chemical processing plant.

'But there are some cities - or at any rate, towns. At least six of them; if they were built for human beings, they could each hold about fifty thousand people. We've called them Rome, Peking, Paris, Moscow, London, Tokyo... They are linked with highways and something that seems to be a rail system.

'There must be enough material for centuries of research in this frozen carcass of a world. We've four thousand square kilometres to explore, and only a few weeks to do it in. I wonder if we'll ever learn the answer to the two mysteries that have been haunting me ever since we got inside; who were they - and what went wrong?'

The recording ended. On Earth and Moon, the members of the Rama Committee relaxed, then started to examine the maps and photographs spread in front of them. Though they had already studied these for many hours, Commander Norton's voice added a dimension which no pictures could convey. He had actually been there - had looked with his own eyes across this extraordinary inside-out world, during the brief moments while its age-long night had been illuminated by the flares. And he was the man who would lead any expedition to explore it.

'Dr Perera, I believe you have some comments to make?'

Ambassador Bose wondered briefly if he should have first given the floor to Professor Davidson, as senior scientist and the only astronomer. But the old cosmologist still seemed to be in a mild state of shock, and was clearly out of his element. All his professional career he had looked upon the universe as an arena for the titanic impersonal forces of gravitation, magnetism, radiation; he had never believed that life played an important role in the scheme of things, and regarded its appearance on Earth, - Mars and Jupiter as an accidental aberration.

But now there was proof that life not only existed outside the solar system, but had scaled heights far beyond anything that man had achieved, or could hope to reach for centuries to come. Moreover, the discovery of Rama challenged another dogma that Professor Olaf had preached for years. When pressed, he would reluctantly admit that life probably did exist in other star systems - but it was absurd, he had always maintained to imagine that it could ever cross the interstellar gulfs...

Perhaps the Ramans had indeed failed, if Commander Norton was correct in believing that their world was now a tomb. But at least they had attempted the feat, on a scale which indicated a high confidence in the outcome. If such a thing had happened once, it must surely have happened many times in this Galaxy of a hundred thousand million suns ... and someone, somewhere, would eventually succeed.

This was the thesis which, without proof but with considerable arm-waving, Dr Carlisle Perera had been preaching for years. He was now a very happy man, though also a most frustrated one. Rama had spectacularly confirmed his views - but he could never set foot inside it, or even see it with his own eyes. If the devil had suddenly appeared and offered him the gift of instantaneous teleportation, he would have signed the contract without bothering to look at the small print.

'Yes, Mr Ambassador, I think I have some information of interest. What we have here is undoubtedly a "Space Ark". It's an old idea in the astronautical literature; I've been able to trace it back to the British physicist J. D. Bernal, who proposed this method of interstellar colonization in a book published in 1929 - yes, two hundred years ago. And the great Russian pioneer Tsiolkovski put forward somewhat similar proposals even earlier.

'If you want to go from one star system to another you have a number of choices. Assuming that the speed of light is an absolute limit - and that's still not completely settled, despite anything you may have heard to the contrary' - there was an indignant sniff, but no formal protest from Professor Davidson - 'you can make a fast trip in a small vessel, or a slow journey in a giant one.

'There seems no technical reason why spacecraft cannot reach ninety per cent, or more, of the speed of light. That would mean a travel time of five to ten years between neighbouring stars - tedious, perhaps, but not impracticable, especially for creatures whose life spans might be measured in centuries. One can imagine voyages of this duration, carried out in ships not much larger than ours.

'But perhaps such speeds are impossible, with reasonable payloads; remember, you have to carry the fuel to slow down at the end of the voyage, even if you're on a one-way trip. So it may make more sense to take your time - ten thousand, a hundred thousand years...

'Bernal and others thought this could be done with mobile worldlets a few kilometres across, carrying thousands of passengers on journeys that would last for generations. Naturally, the system would have to be rigidly closed, recycling all food, air and other expendables. But, of course, that's just how the Earth operates - on a slightly larger scale.

'Some writers suggested that these Space Arks should be built in the form of concentric spheres; others proposed hollow, spinning cylinders so that centrifugal force could provide artificial gravity - exactly what we've found in Rama-'

Professor Davidson could not tolerate this sloppy talk.

'No such thing as centrifugal force. It's an engineer's phantom. There's only inertia.'

'You're quite right, of course,' admitted Perera, 'though it might be hard to convince a man who'd just been slung off a carousel. But mathematical rigour seems unnecessary-

'Hear, hear,' interjected Dr Bose, with some exasperation. 'We all know what you mean, or think we do. Please don't destroy our illusions.'

'Well, I was merely pointing out that there's nothing conceptually novel about Rama, though its size is startling. Men have imagined such things for two hundred years.

'Now I'd like to address myself to another question. Exactly how long has Rama been travelling through space?

'We now have a very precise determination of its orbit and its velocity. Assuming that it's made no navigational changes, we can trace its position back for millions of years. We expected that it would be coming from the direction of a near-by star - but that isn't the case at all.

'It's more than two hundred thousand years since Rama passed near any star, and that particular one turns out to be an irregular variable - about the most unsuitable sun you could imagine for an inhabited solar system. It has a brightness range of over fifty to one; any planets would be alternately baked and frozen every few years.'

'A suggestion,' put in Dr Price. 'Perhaps that explains everything. Maybe this was once a normal sun and became unstable. That's why the Ramans had to find a new one.'

Dr Perera admired the old archaeologist, so he let her down lightly. But what would she say, he wondered, if he started pointing out the instantly obvious in her own speciality...

'We did consider that,' he said gently. 'But if our present theories of stellar evolution are correct, this star could never have been stable - could never have had life-bearing planets. So Rama has been cruising through space for at least two hundred thousand years, and perhaps for more than a million.

'Now it's cold and dark and apparently dead, and I think I know why. The Ramans may have had no choice

- perhaps they were indeed fleeing from some disaster - but they miscalculated.

'No closed ecology can be one hundred per cent efficient; there is always waste, loss - some degradation of the environment, and build-up of pollutants. It may take billions of years to poison and wear out a planet - but it will happen in the end. The oceans will dry up, the atmosphere will leak away...

'By our standards, Rama is enormous - yet it is still a very tiny planet. My calculations, based on the- leakage through its hull, and some reasonable guesses about the rate of biological turnover, indicate that its ecology could only survive for about a thousand years. At the most, I'll grant ten thousand...

'That would be long enough, at the speed Rama is travelling, for a transit between the closely-packed suns in the heart of the Galaxy. But not out here, in the scattered population of the spiral arms. Rama is a ship which exhausted its provisions before it reached its goal. It's a derelict, drifting among the stars.

'There's just one serious objection to this theory, and I'll raise it before anybody else does. Rama's orbit is aimed so accurately at the solar system that coincidence seems ruled out. In fact, I'd say it's now heading much too close to the sun for comfort: Endeavour will have to break away long before perihelion, to avoid overheating.

'I don't pretend to understand this. Perhaps, there ma be some form of automatic terminal guidance still operating, steering Rama to the nearest suitable star ages after its builders are dead.

'And they are dead; I'll stake my reputation on that. All the samples we've taken from the interior are absolutely sterile - we've not found a single micro-organism. As for the talk you may have heard about suspended animation, you can ignore it. There are fundamental reasons why hibernation techniques will only work for a very few centuries - and we're dealing with time spans a thousand-fold longer.

'So the Pandorans and their sympathizers have nothing to worry about. For my part, I'm sorry. It would have been wonderful to have met another intelligent species.

'But at least we have answered one ancient question. We are not alone. The stars will never again be the same to us:

CHAPTER TEN - Descent into Darkness

Commander Norton was sorely tempted - but, as captain his first duty was to his ship. If anything went badly

wrong on this initial probe, he might have to run for it.

So that left his second officer, Lieut-Commander Mercer, as the obvious choice. Norton willingly admitted that Karl was better suited for the mission.

The authority on life-support systems, Macer had written some of - the standard textbooks on the subject. He had personally checked out innumerable types of equipment, often under hazardous conditions, and his biofeedback control was famous. At a moment's notice he could cut his pulse-rate by fifty per cent, and reduce respiration to almost zero for up to ten minutes. These useful little tricks had saved his life on more than one occasion.

Yet despite his great ability and intelligence, he was almost wholly lacking in imagination. To him the most dangerous experiments or missions were simply jobs that had to be done. He never took unnecessary risks, and had no use at all for what was commonly regarded as courage.

The two mottoes on his desk summed up his philosophy of life. One asked WHAT HAVE YOU FORGOTTEN? The other said HELP STAMP our BRAVERY. The fact that, he was widely regarded as the bravest man in the Fleet was the only thing that ever made him angry.

Given Mercer, that automatically selected the next man - his inseparable companion Lt Joe Calvert. It was hard to see what the two had in common; the lightly-built, rather highly strung navigating officer was ten years younger than his stolid and imperturbable friend, who certainly did not share his passionate interest in the art of the primitive cinema.

But no one can predict where lightning will strike, and years ago Mercer and Calvert had established an apparently stable liaison. That was common enough; much more unusual was the fact that they also shared a wife back on Earth, who had borne each of them a child. Commander Norton hoped that he could meet her one day; she must be a very remarkable woman. The triangle had lasted for at least five years, and still seemed to be an equilateral one.

Two men were not enough for an exploring team; long ago it had been found that three was the optimum - for if one man was lost, two might still escape where a single survivor would be doomed. After a good deal of thought, Norton had chosen Technical Sergeant Willard Myron. A mechanical genius who could make anything work - or design something better if it wouldn't - Myron was the ideal man to identify alien pieces of equipment. On a long sabbatical from his regular job as Associate Professor at Astrotech, the Sergeant had refused to accept a commission on the grounds that he did not wish to block the promotion of more deserving career officers. No one

took this explanation very seriously and it was generally agreed that Will rated zero for ambition. He might make it to Space Sergeant, but would never be a full professor. Myron, like countless NCOs before him, had discovered the ideal compromise between power and responsibility.

As they drifted through the last airlock and floated out along the weightless axis of Rama, Lt Calvert found himself, as he so often did, in the middle of a movie flashback. He sometimes wondered if he should attempt to cure himself of this habit, but he could not see that it had any disadvantages. It could make even the dullest situations interesting and - who could tell? - one day it might save his life. He would remember what Fairbanks or Connery or Hiroshi had done in similar circumstances...

This time, he was about to go over the top, in one of the early-twentieth-century wars; Mercer was the sergeant leading a three-man patrol on a night raid into no-man's land. It was not too difficult to imagine that they were at the bottom of an immense shell-crater, though one that had somehow become neatly tailored into a series of ascending terraces. The crater was flooded with light from three widely-spaced plasma-arcs, which gave an almost shadowless illumination over the whole interior. But beyond that - over the rim of the most distant terrace - was darkness and mystery.

In his mind's eye, Calvert knew perfectly well what lay there. First there was the flat circular plain over a kilometre across. Trisecting it into three equal parts, and looking very much like broad railroad tracks, were three wide ladders, their rungs recessed into the surface so that they would provide no obstruction to anything sliding over it. Since the arrangement was completely symmetrical, there was no reason to choose one ladder rather than another; that nearest to Airlock Alpha had been selected purely as a matter of convenience.

Though the rungs of the ladders were uncomfortably far apart, that presented no problem. Even at the rim of the Hub, half a kilometre from the axis, gravity was still barely one thirtieth of Earth's. Although they were carrying almost a hundred kilos of equipment and life-support gear, they would still be able to move easily hand-over-hand.

Commander Norton and the back-up team accompanied them along the guide ropes that had been stretched from Airlock Alpha to the rim of the crater; then, beyond the range of the floodlighis, the darkness of Rama lay before them. All that could be seen in the dancing beams of the helmet lights was the first few hundred metres of the ladder, dwindling away across a flat and otherwise featureless plain.

And now, Karl Mercer told himself, I have to make my

first decision. Am I going up that ladder, or down it?

The question was not a trivial one. They were still essentially in zero gravity, and the brain could select any reference system it pleased. By a simple effort of will, Mercer could convince himself that he was looking out across a horizontal plain, or up the face of a vertical wall, or over the edge of a sheer cliff. Not a few astronauts had experienced grave psychological problems by choosing the wrong coordinates when they started on a complicated job.

Mercer was determined to go head-first, for any other mode of locomotion would be awkward; moreover, this way he could more easily see what was in front of him. For the first few hundred metres, therefore, he would imagine he was climbing upwardsd: only when the increasing pull of gravity made it impossible to maintain the illusion would he switch his mental directions one hundred and eighty degrees.

He grasped the first rung and gently propelled himself along the ladder. Movement was as effortless as swimming along the seabed - more so, in fact, for there was no backward drag of water. It was so easy that there was a temptation to go too fast, but Mercer was much too experienced to hurry in a situation as novel as this.

In his earphones, he could hear the regular breathing of his two companions. He needed no other proof that they were in good shape, and wasted no time in conversation. Though he was tempted to look back, he decided not to risk it until they had reached the platform at the end of the ladder.

The rungs were spaced a uniform half metre apart, and for the first portion of the climb Mercer missed the alternate ones. But he counted them carefully, and at around two hundred noticed the first distinct sensations of weight. The spin of Rama was starting to make itself felt.

At rung four hundred, he estimated that his apparent weight was about five kilos. This was no problem, but it was now getting hard to pretend that he was climbing, when he was being firmly dragged upwards.

The five hundredth rung seemed a good place to pause. He could feel the muscles in his arms responding to the unaccustomed exercise, even though Rama was now doing all the work and he had merely to guide himself.

'Everything OK, Skipper,' he reported. 'We're just passing the halfway mark. Joe, Will - any problems?'

'I'm fine - what are you stopping for?' Joe Calvert answered.

'Same here,' added Sergeant Myron. 'But watch out for the Coriolis force. It's starting to build up.'

So Mercer had already noticed. When he let go of the rungs he had a distinct tendency to drift off to the right. He knew perfectly well that this was merely the effect of Rama's spin, but it seemed as if some mysterious force was gently pushing him away from the ladder.

Perhaps it was time to start going feet-first, now that 'down' was beginning to have a physical meaning. He would run the risk of a momentary disorientation.

'Watch out - I'm going to swing round.'

Holding firmly on to the rung, he used his arms to twist himself round a hundred and eighty degrees, and found himself momentarily blinded by the lights of his companions. Far above them - and now it really was above - he could see a fainter glow along the rim of the sheer cliff. Silhouetted against it were the figures of Commander Norton and the back-up team, watching him intently. They seemed very small and far away, and he gave them a reassuring wave.

He released his grip, and let Rama's still feeble pseudo-gravity take over. The drop from one rung to the next required more than two seconds; on Earth, in the same time, a man would have fallen thirty metres.

The rate of fall was so painfully slow that he hurried things up a trifle by pushing with his hands, gliding over spans of a dozen rungs at a time, and checking himself with his feet whenever he felt he was travelling too fast.

At rung seven hundred, he came to another halt and swung the beam of his helmet-lamp downwards; as he had calculated, the beginning of the stairway was only fifty metres below.

A few minutes later, they were on the first step. It was a strange experience, after months in space, to stand upright on a solid surface, and to feel it pressing against one's feet. Their weight was still less than ten kilogrammes, but that was enough to give a feeling of stability. When he closed his eyes, Mercer could believe that he once more had a real world beneath him.

The ledge or platform from which the stairway descended was about ten metres wide, and curved upwards on each side until it disappeared into the darkness. Mercer knew that it formed a complete circle and that if he walked along it for five kilometres he would come right back to his starting-point, having circumnavigated Rama.

At the fractional gravity that existed here, however,

real walking was impossible; one could only bound along in giant strides. And therein lay danger.

The stairway that swooped down into the darkness, far below the range of their lights, would be deceptively easy to descend. But it would be essential to hold on to the tall handrail that flanked it on either side; too bold a step might send an incautious traveller arching far out into space. He would hit the surface again perhaps a hundred metres lower down; the impact would be harmless, but its consequences might not be - for the spin of Rama would have moved the stairway off to the left. And so a falling body would hit against the smooth curve that swept in an unbroken arc to the plain almost seven kilometres below.

That, Mercer told himself, would be a hell of a toboggan ride; the terminal speed, even in this gravity, could be several hundred kilometres an hour. Perhaps it would be possible to apply-enough friction to check such a headlong descent; if so, this might even be the most convenient way to reach the inner surface of Rama. But some very cautious experimenting would be necessary first.

'Skipper,' reported Mercer, 'there were no problems getting down the ladder. If you agree, I'd like to continue towards the next platform. I want to time our rate of descent on the stairway.'

Norton replied without hesitation.

'Go ahead.' He did not need to add, 'Proceed with caution.'

It did not take Mercer long to make a fundamental discovery. It was impossible, at least at this one-twentieth-of-a-gravity level, to walk down the stairway in the normal manner. Any attempt to do so resulted in a slow-motion dream-like movement that was intolerably tedious; the only practical way was to ignore the steps, and to use the handrail to pull oneself downwards.

Calvert had come to the same conclusion.

'This stairway was built to walk up, not down!' he exclaimed. 'You can use the steps when you're moving against gravity, but they're just a nuisance in this direction. It may not be dignified, but I think the best way down is to slide along the handrail.'

'That's ridiculous,' protested Sergeant Myron. 'I can't believe the Ramans did it this way.' -

'I doubt if they ever used this stairway - it's obviously only for emergencies. They must have had some mechanical transport system to get up here. A funicular, per-

haps. That would explain those long slots running down from the Hub.'

'I always assumed they were drains - but I suppose they could be both. I wonder if it ever rained here?'
'Probably,' said Mercer. 'But I think Joe is right, and to hell with dignity. Here we go.'

The handrail - presumably it was designed for something like hands7 was a smooth, flat, metal bar supported on widely-spaced pillars a metre high. Commander Mercer straddled it, carefully gauged the braking power he could exert with his hands, and let himself slide.

Very sedately, slowly picking up speed, he descended into the darkness, moving in the pool of light from his helmet-lamp. He had gone about fifty metres when he called the others to join him.

None would admit it, but they all felt like boys again. sliding down the banisters. In less than two minutes, they had made a kilometre descent in safety and comfort.

Whenever they felt they were going too fast,. a tightened grip on the handrail provided all the braking that was necessary.

'I hope you enjoyed yourselves,' Commander Norton called when they stepped off at the second platform. 'Climbing back won't be quite so easy.'

'That's what I want to check,' replied Mercer, who was walking experimentally back and forth, getting the feel of the increased gravity. 'It's already a tenth of a gee here - you really notice the difference.'

He walked - or, more accurately, glided - to the edge of the platform, and shone his helmet-light down the next section of the stairway. As far as his beam could reach, it appeared identical with the one above - though careful examination of photos had shown that the height of the steps steadily decreased with the rising gravity. The stair had apparently been designed so that the effort required to climb it was more or less constant at every point in its long curving sweep.

Mercer glanced up towards the Hub of Rama, now almost two kilometres above him. The little glow of light, and the tiny figures silhouetted against it, seemed horribly far away. For the first time, he was suddenly glad that he could not see the whole length of this enormous stairway. Despite his steady nerves and lack of imagination, he was not sure how he would react if he could see himself like an insect crawling up the face of a vertical saucer more than sixteen kilometres high - and with the upper half overhanging above him. Until this moment, he had regarded the darkness as a nuisance; now he al-

most welcomed it.

'There's no change of temperature,' he reported to Commander Norton. 'Still just below freezing. But the air-pressure is up, as we expected - around three hundred millibars. Even with this low oxygen content, it's almost breathable; further down there will be no problems at all. That will simplify exploration enormously. 'What a find - the first world on which we can walk without breathing gear! In fact, I'm going to take a sniff.'

Up on the Hub, Commander Norton stirred a little uneasily. But Mercer, of all men, knew exactly what he was doing. He would already have made enough tests to satisfy himself.

Mercer equalized pressure, unlatched the securing clip of his helmet, and opened it a crack. He took a cautious breath; then a deeper one.

The air of Rama was dead and musty, as if from a tomb so ancient that the last trace of physical corruption had disappeared ages ago. Even Mercer's ultra-sensitive nose, trained through years of testing life-support systems to and beyond the point of disaster, could detect no re-cognizable odours. There was a faint metallic tang, and he suddenly recalled that the first men on the Moon had reported a hint of burnt gunpowder when they repres-surized the lunar module. Mercer imagined that the moon-dust-contaminated cabin on Eagle must have smelled rather like Rama.

He sealed the helmet again, and emptied his lungs of the alien air. He had extracted no sustenance from it; even a mountaineer acclimatized to the summit of Ever-est would die quickly here. But a few kilometres further down, it would be a different matter.

'What else was -there to do here? He could think of nothing, except the enjoyment of the gentle, unaccust-omed gravity. But there was no point in growing used to that, since they would be returning immediately to the weightlessness of the Hub.

'We're coming back, Skipper,' he reported. 'There's no reason to go further - until we're ready to go all the way.'

'I agree. We'll be timing you, but take it easy.'

As he bounded up the steps, three or four at a stride, Mercer agreed that Calvert had been perfectly correct; these stairs were built to be walked up, not down. As long as one did not look back, and ignored the - vertiginous steepness of the ascending curve, the climb was a delight-ful experience. After about two hundred steps, however, he began to feel some twinges in his calf muscles, and decided to slow down. The others had done the same;

when he ventured a quick glance over his shoulder, they were considerably further down the slope.

The climb was wholly uneventful - merely an- apparently endless succession of steps. When they stood once more on the highest platform, immediately beneath the ladder, they were barely winded, and it had taken them only ten minutes. They paused for another ten, then started on the last vertical kilometre.

Jump - catch hold of a rung - jump - catch - jump - catch... it was easy, but so boringly repetitious that there was danger of becoming careless. Halfway up the ladder they rested for five minutes: by this time their arms as well as their legs had begun to ache. Once again, Mercer was glad that they could see so little of the vertical face to which they were clinging; it was not too difficult to pretend that the ladder only extended just a few metres beyond their circle of light, and would soon come to an - end.

Jump - catch a rung - jump - then, quite suddenly, the ladder really ended. They were back at the weightless world of the axis, among their anxious friends. The whole trip had taken under an hour, and they felt a sense of modest achievement.

But it was much too soon to feel pleased with themselves. For all their efforts, they had traversed less than an eighth of that cyclopean stairway.

CHAPTER ELEVEN - Men, Women and Monkeys

Some women, Commander Norton had decided long ago, should not be allowed aboard ship; weightlessness did things to their breasts that were too damn distracting. It was bad enough when they were motionless; but when they started to move, and sympathetic vibrations set in, it was more than any warm-blooded male should be asked to take. He was quite sure that at least one serious space accident had been caused by acute crew distraction, after the transit of a well-upholstered lady officer through the control cabin.

He had once mentioned this theory to Surgeon-Commander Laura Ernst, without revealing who had inspired his particular train of thought. There was no need; they knew each other much too well. On Earth, years ago, in a moment of mutual loneliness and depression, they had once made love. Probably they would never repeat the experience (but could one ever be quite sure of that?) because so much had changed for both of them. Yet whenever the well-built Surgeon oscillated into the Commander's cabin, he felt a fleeting echo, of an old passion, she knew that he felt it, and everyone was happy.

'Bill,' she began, 'I've checked our mountaineers, and

here's my verdict. Karl and Joe are in good shape - all indications normal for the work they've done. But Will shows signs of exhaustion and body-loss - I won't bother about the details. I don't believe he's been getting all the exercise he should, and he's not the only one. There's been some cheating in the centrifuge; if there's any more, heads will roll. Please pass the word.'

'Yes, Ma'am. But there's some excuse. The men have been working very hard.'

'With their brains and fingers, certainly. But not with their bodies - not real work in kilogramme-metres. And that's what we'll be dealing with, if we're going to explore Rama.'

'Well, can we?'

'Yes, if we proceed with caution. Karl and I have worked out a very conservative profile - based on the assumption that we can dispense with breathing gear below Level Two. Of course, that's an incredible stroke of luck, and changes the whole logistics picture. I still can't get used to the idea of a world with oxygen... So we only need to supply food and water and thermosuits, and we re in business. Going down will be easy; it looks as if we can slide most of the way, on that very convenient banister.'

'I've got Chips working on a sled with parachute braking. Even if we can't risk it for crew, we can use it for stores and equipment.'

'Fine; that should do the trip in ten minutes; otherwise it will take about an hour.

'Climbing up is harder to estimate; I'd like to allow six hours, including two one-hour periods. Later, as we get experience - and develop some muscles - we may be able to cut this back considerably.'

'What about psychological factors?'

'Hard to assess, in such a novel environment. Darkness may be the biggest problem.

'I'll establish searchlights on the Hub. Besides its own lamps, any party down there will always have a beam playing on it.'

'Good - that should be a great help.'

'One other point: should we play safe and send a party only halfway down the stair - and back - or should we go the whole way on the first attempt?'

'If we had plenty of time, I'd be cautious. But time is

short, and I can see no danger in going all- the way - and looking around when we get there.'

'Thanks, Laura - that's all I want to know. I'll get the Exec working on the details. And I'll order all hands to the centrifuge - twenty minutes a day at half a gee. Will that satisfy you?'

'No. It's point six gee down there in Rama, and I want a safety margin. Make it three quarters-'

'Ouch!'

'-for ten minutes-'

I'll settle for that-'

'-twice a day.'

'Laura, you're a cruel, hard woman. But so be it. I'll break the news just before dinner. That should spoil a few appetites.'
It was the first time that Commander Norton had ever seen Karl Mercer slightly ill at ease. He had spent the fifteen minutes discussing the logistics problem in his usual competent manner, but something was obviously worrying him. His captain, who had a shrewd idea of what it was, waited patiently until he brought it out.

'Skipper,' Karl said at length, 'are you sure you should lead this party? If anything goes wrong, I'm considerably more expendable. And I've been further inside Rama than anyone else - even if only by fifty metres.'

'Granted. But it's time the commander led his troops, and we've decided that there's no greater risk on this trip than on the last. At the first sign of trouble, I'll be back up that stairway fast enough to qualify for the Lunar Olympics.'

He waited for any further objections, but none came, though Karl still looked unhappy. So he took pity on him and added gently: 'And I bet Joe will beat me to the top.'

The big man relaxed, and a slow grin spread across his face. 'All the same, Bill, I wish you'd taken someone else.'
'I wanted one man who'd been down before, and we can' t both go. As for Herr Doctor Professor Sergeant Myron, Laura says he's still two kilos overweight. Even shaving off that moustache didn't help.'

'Who's your number three?'

'I still haven't decided. That depends on Laura.'

'She wants to go herself.'

'Who doesn't? But if she turns up at the top of her own fitness list, I'll be very suspicious.

As Lieut-Commander Mercer gathered up his papers and launched himself out of the cabin, Norton felt a brief stab of envy. Almost all the crew - about eighty-five per cent, by his minimum estimate - had worked out some sort of emotional accommodation. He had known ships where the captain had done the same, but that was not his way. Though discipline aboard the Endeavour was based very largely on the mutual respect between highly trained and intelligent men and women, the commander needed something more to underline his position. His responsibility was unique, and demanded a certain degree of isolation, even from his closest friends. Any liaison could be damaging to morale, for it was almost impossible to avoid charges of favouritism. - For this reason, affairs spanning more than two degrees of rank were firmly discouraged; but apart from this, the only rule regulating shipboard sex was 'So long as they don't do it in the corridors and frighten the simps'.

There were four superchimps aboard Endeavour, though strictly speaking the name was inaccurate, because the ship's non-human crew was not based on chimpanzee stock. In zero gravity, a prehensile tail is an enormous advantage, and all attempts to supply these to humans had turned into embarrassing failures. After equally unsatisfactory results with the great apes, the Superchimpanzee Corporation had turned to the monkey kingdom.

Blackie, Blondie, Goldie and Brownie had family trees whose branches included the most intelligent of the Old and New World monkeys, plus synthetic genes that had never existed in nature. Their rearing and education had probably cost as much as that of the average spaceman, and they were worth it. Each weighed less than thirty kilos and consumed only half the food and oxygen of a human being, but each could replace 2.75 men for housekeeping, elementary cooking, tool-carrying and dozens of other routine jobs.

That 2.75 was the Corporation's claim, based on innumerable time-and-motion studies. The figure, though surprising and frequently challenged, appeared to be accurate, for simps were quite happy to work fifteen hours a day and did not get bored by the most menial and repetitious tasks. So they freed human beings for human work; and on a spaceship, that was a matter of vital importance.

Unlike the monkeys who were their nearest relatives Endeavour's simps were docile, obedient and uninquisitive. Being cloned, they were also sexless, which eliminated awkward behavioural problems. Carefully house-trained vegetarians, they were very clean and didn't

smell; they would have made perfect pets, except that nobody could possibly have afforded them.

Despite these advantages, having simps on board involved certain problems. They had to have their own quarters - inevitably labelled 'The Monkey House'. Their little mess-room was always spotless, and was well-equipped with TV, games equipment and programmed teaching machines. To avoid accidents, they were absolutely forbidden - to enter the ship's technical areas; the entrances to all these were colour-coded in red, and the simps were conditioned so that it was psychologically impossible for them to pass the visual barriers.

There was also a communications problem. Though they had an equivalent IQ of sixty, and could understand several hundred words of English, they were unable to talk. It had proved impossible to give useful vocal chords either to apes or monkeys, and they therefore had to express themselves in sign language.

The basic signs were obvious and easily learned, so that everyone on board ship could understand routine messages. But the only man who could speak fluent Simpish was their handler - Chief Steward McAndrews.

It was a standing joke that Sergeant Ravi McAndrews looked rather like a simp - which was hardly an insult, for with their short, tinted pelts and graceful movements they were very handsome animals. They were also affectionate, and everyone on board had his favourite; Commander Norton's was the aptly-named Goldie.

But the warm relationship which one could so easily establish with simps created another problem, often used as a powerful argument against their employment in space. Since they could only be trained for routine, low-grade tasks, they were worse than useless in an emergency; they could then be a danger to themselves and to their human companions. In particular, teaching them to use spacesuits had proved impossible, the concepts involved being quite beyond their understanding.

No one liked to talk about it, but everybody knew what had to be done if a hull was breached or the order came to abandon ship. It had happened only once; then the simp handler had carried out his instructions more than adequately. He was found with his charges, killed by the same poison. Thereafter the - job of euthing was transferred to the chief medical officer, who it was felt would have less emotional involvement.

Norton was very thankful that this responsibility, at least, did not fall upon the captain's shoulders. He had known men he would have killed with far fewer qualms than he would Goldie.

CHAPTER TWELVE - The Stairway of the Gods

In the clear, cold atmosphere of Rama, the beam of the searchlight was completely invisible. Three kilometres down from the central Hub, the hundred-metre wide oval of light lay across a section of that colossal stairway. A brilliant oasis in the surrounding darkness, it was sweeping slowly towards the curved plain still five kilometres below; and in its centre moved a trio of ant-like figures, casting long shadows before them.

It had been, just as they had hoped and expected, a completely uneventful descent. They had paused briefly at the first platform, and Norton had walked a few hundred metres along the narrow, curving ledge before starting the slide down to the second level. Here they had discarded their oxygen gear, and revelled in the strange luxury of being able to breathe without mechanical aids. Now they could explore in comfort, freed from the greatest danger that confronts a man in space, and forgetting all worries about suit integrity and oxygen reserve.

By the time they had reached the fifth level, and there was only one more section to go, gravity had reached almost half its terrestrial value. Rama's centrifugal spin was at last exerting its real strength; they were surrendering themselves to the implacable force which rules every planet, and which can exert a merciless price for the smallest slip. It was still very easy to go downwards; but the thought of the return, up those thousands upon thousands of steps, was already beginning to prey upon their minds.

The stairway had long - ago ceased its vertiginous downward plunge and was now flattening out towards the horizontal. The gradient was now only about s in 5; at the beginning, it had been 5 in i. Normal walking was now both physically, and psychologically, acceptable; only the lowered gravity reminded them that they were not descending some great stairway on Earth. Norton had once visited the ruins of an Aztec temple, and the feelings he had then experienced came echoing back to him - amplified a hundred times. Here was the same sense of awe and mystery, and the sadness of the irrevocably vanished past. Yet the scale here was so much greater, both in time and space, that the mind was unable to do it justice; after a while, it ceased to respond. Norton wondered if, sooner or later, he would take even Rama for granted.

And there was another respect in which the parallel with terrestrial ruins failed completely. Rama was hundreds of times older than any structure that had survived on Earth - even the Great Pyramid. But everything looked absolutely new; there was no sign of wear and tear.

Norton had puzzled over this a good deal, and had

arrived at a tentative explanation. Everything that they had so far examined was part of an emergency back-up system, very seldom put to actual use. He could not imagine that the Ramans - unless they were physical fitness fanatics of the kind not uncommon on Earth - ever walked up and down this incredible stairway, or its two identical companions completing the invisible Y far above his head. Perhaps they had only been required during the actual construction of Rama, and had served no purpose since that distant day. That theory would do for the moment, yet it did not feel right. There was something wrong, somewhere...

They did not slide for the last kilometre but went down the steps two at a time in long, gentle strides; this way, Norton decided, they would give more exercise to muscles that would soon have to be used. And so the end of the stairway came upon them almost unawares; suddenly, there were no more steps - only a flat plain, dull grey in the now weakening beam of the Hub searchlight, fading away into the darkness a few hundred metres ahead.

Norton looked back along the beam, towards its source up on the axis more than eight kilometres away. He knew that Mercer would be watching through the telescope, so he waved to him cheerfully.

'Captain here,' he reported over the radio. 'Everyone in fine shape - no problems. Proceeding as planned.'

'Good,' replied Mercer. 'We'll be watching.'

There was a brief silence; then a new voice cut in. 'This is the Exec, on board ship. Really, Skipper, this isn't good enough. You know the news services have been screaming at us for the last week. I don't expect deathless prose, but can't you do better than that?'

'I'll try,' Norton chuckled. 'But remember there's nothing to see yet. It's like - well, being on a huge, darkened stage, with a single spotlight. The first few hundred steps of the stairway, rise out of it until they disappear into the darkness overhead. What we can see of the plain looks perfectly flat - the curvature's too small to be visible over this limited area. And that's about it.'

'Like to give any impressions?'

'Well, it's still very cold - below freezing - and we're glad of our thermosuits. And quiet of course; quieter than anything I've ever known on Earth, or in space, where there's always some background noise. Here, every sound is swallowed up; the space around us is so enormous that there aren't any echoes. It's weird, but I hope we'll get used to it.'

'Thanks, Skipper. Anyone else - Joe, Boris?'

Lt Joe Calvert, never at a loss for words, was happy to oblige.

'I can't help thinking that this is the first time - ever - that we've been able to walk on another world, breathing its natural atmosphere - though I suppose "natural" is hardly the word you can apply to a place like this. Still, Rama must resemble the world of its builders; our own spaceships are all miniature earths. Two examples are damned poor statistics, but does this mean that all intelligent life-forms are oxygen eaters? What we've seen of their work suggests that the Ramans were humanoid, though perhaps about fifty per cent taller than we are. Wouldn't you agree, Boris?'

Is Joe teasing Boris? Norton asked himself. I wonder how he's going to react? ...

To all his shipmates, Boris Rodrigo was something of an enigma. The quiet, dignified communications officer was- popular with the rest of the crew, but he never entered fully into their activities and always seemed a little apart - marching to the music of a different drummer.

As indeed he was, being a devout member of the Fifth Church of Christ, Cosmonaut. Norton had never been able to discover what had happened to the earlier four, and he was equally in the dark about the Church's rituals and ceremonies. But the main tenet of its faith was well known: it believed that Jesus Christ was a visitor from space, and had constructed an entire theology on that assumption.

It was perhaps not surprising that an unusually high proportion of the Church's devotees worked in space in some capacity or other. Invariably, they were efficient, conscientious and absolutely reliable. They were universally respected and even liked, especially as they made no attempt to convert others. Yet there was also something slightly spooky about them; Norton could never understand how men with advanced scientific and technical training could possibly believe some of the things he had heard Christers state as incontrovertible facts.

As he waited for Lt Rodrigo to answer Joe's possibly loaded question, the commander had a sudden insight into his own hidden motives. He had chosen Boris because he was physically fit, technically qualified, and completely dependable. At the same time, he wondered if some part of his mind had not selected the lieutenant out of an almost mischievous curiosity. How would a man with such religious beliefs react to the awesome reality of Rama? Suppose he encountered something that confounded his theology ... or, for that matter, confirmed it?

But Boris Rodrigo, with his usual caution, refused to be drawn.

'They were certainly oxygen breathers, and they could be humanoid. But let's wait and see. With any luck, we should discover what, they were like. There may be pictures, statues - perhaps even bodies, over in those towns. If they are towns.'

'And the nearest is only eight kilometres away,' said Joe Calvert hopefully.

Yes, thought the commander, but it's also eight kilometres back - and then there's that overwhelming stairway to climb again. Can we take the risk?

A quick sortie to the 'town' which they had named Paris had been among the first of his contingency plans, and now he had to make his decision. They had ample food and water for a stay of twenty-four hours; they would always be in full view of the back-up team on the Hub, and any kind of accident seemed virtually impossible on this smooth, gently curving, metal plain. The only foreseeable danger was exhaustion; when they got to Paris, which they could do easily enough, could they do more than take a few photographs and perhaps collect some small artifacts, before they had to return?

But even such a brief foray would be worth it; there was so little time, as Rama hurtled sunwards towards a perihelion too dangerous for Endeavour to match.

In any case, part of the decision was not his to make. Up in the ship, Dr Ernst would be watching the outputs of the bio-telemetering sensors attached to his body. If she turned thumbs-down, that would be that.

'Laura, what do you think?'

'Take thirty minutes' rest, and a five hundred calorie energy module. Then you can start.'

'Thanks, Doc,' interjected Joe Calvert. 'Now I can die happy. I always wanted to see Paris. Montmartre, here we come.'

CHAPTER THIRTEEN - The Plain of Rama

After those interminable stairs, it was a strange luxury to walk once more on a horizontal surface. Directly ahead, the ground was indeed completely flat; to right and left, at the limits of the floodlit area, the rising curve could just be detected. They might have been walking along a very wide, shallow valley; it was quite impossible to believe that they were really crawling along the inside of a huge cylinder, and that beyond this little oasis of light

the land rose up to meet - no, to become - the sky.

Though they all felt a sense of confidence and subdued excitement, after a while the almost palpable silence of Rama began to weigh heavily upon them. Every footstep, every word, vanished instantly into the unreverberant void; after they had gone little more than half a kilometre, Lt Calvert could stand it no longer.

Among his minor accomplishments was a talent now rare, though many thought not rare enough - the art of whistling. With or without encouragement he could reproduce the themes from most of the movies of the last two hundred years. He started appropriately with Heigh-ho, heigh-ho, 'tis off to work we go, found that he couldn't stay down comfortably in the bass with Disney's marching dwarfs, and switched quickly to River Kwai. Then he progressed, more or less chronologically, through half a dozen epics, culminating with the theme from Sid Krassman's famous late-twentieth-century Napoleon.

It was a good try, but it didn't work, even as a morale-builder. Rama needed the grandeur of Bach or Beethoven or Sibelius or Tuan Sun, not the trivia of popular entertainment. Norton was on the point of suggesting that Joe save his breath for later exertions, when the young officer realized the inappropriateness of his efforts. Thereafter, apart from an occasional consultation with the ship, they marched on in silence. Rama had won this round.

On his initial traverse, Norton had allowed for one detour. Paris lay straight ahead, halfway between the foot of the stairway and the shore of the Cylindrical Sea, but only a kilometre to the right of their track was a very prominent, and rather mysterious, feature which had been christened the Straight Valley. It was a long groove or trench, forty metres deep and a hundred wide, with gently sloping sides; it had been provisionally identified as an irrigation ditch or canal. Like the stairway itself, it had two similar counterparts, equally spaced around the curve of Rama.

The three valleys were almost ten kilometres long, and stopped abruptly just before they reached the Sea - which was strange, if they were intended to carry water. And on the other side of the Sea the pattern was repeated: three more ten-kilometre-trenches continued on to the South Polar region.

They reached the end of the Straight Valley after only fifteen minutes' comfortable walking, and stood for a while staring thoughtfully into its depths. The perfectly smooth walls sloped down at an angle of sixty degrees; there were no steps or footholds. Filling the bottom was a sheet of flat, white material that looked very much like ice. A specimen could settle a good many arguments;

Norton decided to get one.

With Calvert and Rodrigo acting as anchors and paying out a safety rope, he rapelled slowly down the steep incline. When he reached the bottom, he fully expected to find the familiar slippery feel of ice underfoot, but he was mistaken. The friction was too great; his footing was secure. This material was some kind of glass or transparent crystal; when he touched it with his fingertips, it was cold, hard and unyielding.

Turning his back to the searchlight and shielding his eyes from its glare. Norton tried to peer into the crystalline depths, as one may attempt to gaze through the ice of a frozen lake. But he could see nothing; even when he tried the concentrated beam of his own helmet-lamp. he was no more successful. This stuff was translucent, but not transparent. If it was a frozen liquid, it had a melting-point very much higher than water.

He tapped it gently with the hammer from his geology kit; the tool rebounded with a dull, unmusical 'dunk'. He tapped harder, with no more result, and was about to exert his full strength when some impulse made him desist.

It seemed most unlikely that he could crack this material; but what if he did? He would be like a vandal, smashing some enormous plate-glass window. There would be a better opportunity later, and at least he had discovered valuable information. It now seemed more unlikely than ever that this was a canal; it was simply a peculiar trench that stopped and started abruptly, but led nowhere. And if at any time it had carried liquid, where were the stains, the encrustations of dried-up sediment, that one would expect? Everything was bright and clean, as if the builders had left only yesterday...

Once again he was face to face with the fundamental mystery of Rama, and this time it was impossible to evade it. Commander Norton was a reasonably imaginative man, but he would never have reached his present position if he had been liable to the wilder flights of fancy. Yet now, for the first time, he had a sense - not exactly of foreboding, but of anticipation. Things were not what they seemed; there was something very, very odd about a place that was simultaneously brand new - and a million years old.

Very thoughtfully, he began to walk slowly along the length of the little valley, while his companions. still holding the rope that was attached to his waist, followed him along the rim. He did not expect to make any further discoveries, but he wanted to let his curious emotional state run its course. For something else was worrying him; and it had nothing to do with the inexplicable newness of Rama.

He had walked no more than a dozen metres when it hit him like a thunderbolt.

He knew this place. He had been here before. Even on Earth, or some familiar planet, that experience is disquieting, though it is not particularly rare. Most men have known it at some time or other, and usually they dismiss it as the memory of a forgotten photograph, a pure coincidence - or, if they are mystically inclined, some form of telepathy from another mind, or even a flashback from their own future.

But to recognize a spot which no other human being can possibly have seen - that is quite shocking. For several seconds, Commander Norton stood rooted to the smooth crystalline surface on which he had been walking, trying to straighten out his emotions. His well-ordered universe had been turned upside down, and he had a dizzying glimpse of those mysteries at the edge of existence which he had successfully ignored for most of his life.

Then, to his immense relief, common sense came to the rescue. The disturbing sensation of déjà-vu faded out, to be replaced by a real and identifiable memory from his youth.

It was true - he had once stood between such steeply sloping walls, watching them drive into the distance until they seemed to converge at a point indefinitely far ahead. But they had been covered with neatly trimmed grass; and underfoot had been broken stone, not smooth crystal.

It had happened thirty years ago, during a summer vacation in England. Largely because of another student (he could remember her face - but he had forgotten her name) he had taken a course of industrial archaeology, then very popular among science and engineering graduates. They had explored abandoned coal-mines and cotton mills, climbed over ruined blast-furnaces and steam-engines, goggled unbelievingly at primitive (and still dangerous) nuclear reactors, and driven priceless' turbine-powered antiques along restored motor roads.

Not everything that they saw was genuine; much had been lost during the centuries, for men seldom bother to preserve the commonplace articles of everyday life. But where it was necessary to make copies, they had been reconstructed with loving care.

And so young Bill Norton had found himself bowling along, at an exhilarating hundred kilometres an hour, while he furiously shovelled precious coal into the firebox of a locomotive that looked two hundred years old, but was actually younger than he was. The thirty-kilometre

stretch of the Great Western Railway, however, was quite genuine, though it had required a good deal of excavating to get it back into commission.

Whistle screaming, they had plunged into a hillside and raced through a smoky, flame-lit darkness. An astonishingly long time later, they had burst out of the tunnel into a deep, perfectly straight cutting between steep grassy banks. The long-forgotten vista was almost identical with the one before him now.

'What is it, Skipper?' called Lt Rodrigo. 'Have you found something?'

As Norton dragged himself back to present reality, some of the oppression lifted from his mind. There was mystery here - yes; but it might not be beyond human understanding. He had learned a lesson, though it was not one that he could readily impart to others. At all costs, he must not let Rama overwhelm him. That way lay failure - perhaps even madness.

'No,' he answered, 'there's nothing down here. Haul me up - we 11 head straight to Paris.'

CHAPTER FOURTEEN - Storm Warning

'I've called this meeting of the Committee,' said His Excellency the Ambassador of Mars to the United Planets, 'because Dr Perera has something important to tell us. He insists that we get in touch with Commander Norton right away, using the priority channel we've been able to establish after, I might say, a good deal of difficulty. Dr Perera's statement is rather technical, and before we come to it I think a summary of the present position might be in order; Dr Price has prepared one. Oh yes - some apologies for absence. Sir Lewis Sands is unable to be with us because he's chairing a conference, and Dr Taylor asks to be excused?

He was rather pleased about that last abstention. The anthropologist had rapidly lost interest in Rama, when it became obvious that it would present little scope for him. Like many others, he had been bitterly disappointed to find that the mobile worldlet was dead; now there would be no opportunity for sensational books and viddies about Raman rituals and behavioural patterns. Others might dig up skeletons and classify artifacts; that sort of thing did not appeal to Conrad Taylor. Perhaps the only discovery that would bring him back in a hurry would be some highly explicit works of art, like the notorious frescoes of Thera and Pompeii. -

Thelma Price, the archaeologist, took exactly the opposite point of view. She preferred excavations and ruins uncluttered by inhabitants who might interfere with dispassionate, scientific studies. The bed of the Mediter-

ranean had been ideal - at least until the city planners and landscape artists had started getting in the way. And Rama would have been perfect, except for the maddening detail that it was a hundred million kilometres away and she would never be able to visit it in person.

'As you all know,' she began, 'Commander Norton has completed one traverse of almost thirty kilometres, without encountering any problems. He explored the curious trench shown on your maps as the Straight Valley; its purpose is still quite unknown, but it's clearly important as it runs the full length of Rama - except for the break at the Cylindrical Sea - and there are two other identical structures 120 degrees apart round the circumference of -the world.

'Then the party turned left - or East, if we adopt the North Pole convention - until they reached Paris. As you'll see from this photograph, taken by a telescope camera at the Hub, it's a group of several hundred buildings, with wide streets between them.

'Now these photographs were taken by Commander Norton's group when they reached the site. If Paris is a city, it's a very peculiar one. Note that none of the buildings have windows, or even doors! They are all plain rectangular structures, an identical thirty-five metres high. And they appear to have been extruded out of the ground - there are no seams or joints - look at this close-up of the base of a wall - there's a smooth transition into the ground.

'My own feeling is that this place is not a residential area, but a storage or supply depot. In support of that theory, look at this photo

'These narrow slots or grooves, about five centimetres wide, run along all the streets, and there's one leading to every building - going straight into the wall .There's a striking resemblance to the street-car tracks of the early twentieth century; they are obviously part of some transport system.

'We've never considered it necessary to have public transport direct to every house. It would be economically absurd - people can always walk a few hundred metres. But if these buildings are used for the storage of heavy materials, it would make sense.

'May I ask a question?' said the Ambassador for Earth.

'Of course, Sir Robert.'

'Commander Norton couldn't get into a single building?'

'No; when you listen to his report, you can tell he was

quite frustrated. At one time he decided that the buildings could only be entered from underground; then he discovered the grooves of the transport system, and changed his mind.'

'Did he try to break in?'

'There was no way he could, without explosives or heavy tools. And he doesn't want to do that until all other approaches have failed.'

'I have it!' Dennis Solomons suddenly interjected. 'Cocooning!'

'I beg your pardon?'

'It's a technique developed a couple of hundred years ago,' continued the science historian. 'Another name for it is moth-balling. When you have something you want to preserve, you seal it inside a plastic envelope, and then pump in an inert gas. The original use was to protect military equipment between wars; it was once applied to whole ships. It's still widely used in museums that are short of storage space; no one knows what's inside some of the hundred-year-old cocoons in the Smithsonian basement.'

Patience was not one of Carlisle Perera's virtues; he was aching to drop his bombshell, and could restrain himself no longer.

'Please, Mr Ambassador! This is all very interesting, but I feel my information is rather more urgent.'

'If there are no other points - very well, Dr Perera.'

The exobiologist, unlike Conrad Taylor, had not found Rama a disappointment. It was true that he no longer expected to find life - but sooner or later, he had been quite sure, some remains would be discovered of the creatures who had built this fantastic world. The exploration had barely begun, although the time available was horribly brief before Endeavour would be forced to escape from her present sun-grazing orbit.

But now, if his calculations were correct, Man's contact with Rama would be even shorter than he had feared. For one detail had been overlooked - because it was so large that no one had noticed it before.

'According to our latest information,' Perera began, 'one party is now on its way to the Cylindrical Sea, while Commander Norton has another group setting up a supply base at the foot of Stairway Alpha. When that's established, he intends to have at least two exploratory missions operating at all times. In this way he hopes to use his limited manpower at maximum efficiency.

• 'It's a good plan, but there may be no time to carry it out. In fact, I would advise an immediate alert, and a preparation for total withdrawal at twelve hours' notice. Let me explain...

'It's surprising how few people have commented on a rather obvious anomaly about Rama. It's now well inside the orbit of Venus - yet the interior is still frozen. But the temperature of an object in direct sunlight at this point is about five hundred degrees!

'The reason of course, is that Rama hasn't had time to warm up. It must have cooled down to near absolute zero - two hundred and seventy below - while it was in interstellar space. Now, as it approaches the sun, the outer hull is already almost as hot as molten lead. But the inside will stay cold, until the heat works its way through that kilometre of rock.

'There's some kind of fancy dessert with a hot exterior and ice-cream in the middle - I don't remember what it's called-'

'Baked Alaska. It's a favourite at UP banquets, unfortunately.'

'Thank you, Sir Robert. That's the situation in Rama at the moment, but it won't last. All these weeks, the solar heat has been working its way through, and we expect a sharp temperature rise to begin in a few hours. That's not the problem; by the time we'll have to leave anyway, it will be no more than comfortably tropical.'

'Then what's the difficulty?'

'I can answer in one word, Mr Ambassador. Hurricanes.'

CHAPTER FIFTEEN - The Edge of the Sea

There were now more than twenty men and women inside Rama - six of them down on the plain, the rest ferrying equipment and expendables through the airlock system and down the stairway. The ship itself was almost deserted, with the minimum possible staff on duty; the joke went around that Endeavour was really being run by the four simps and that Goldie had been given the rank of Acting-Commander.

For these first explorations, Norton had established a number of ground-rules; the most important dated back to the earliest days of man's space-faring. Every group, he had decided, must contain one person with prior experience. But not more than one. In that way, everybody would have an opportunity of learning as quickly as possible.

And so the first party to head for the Cylindrical Sea, though it was led by Surgeon-Commander Laura Ernst, had as its one-time veteran Lt Boris Rodrigo, just back from Paris. The third member, Sergeant Pieter Rousseau, had been with the back-up teams at the Hub; he was an expert on space reconnaissance instrumentation, but on this trip he would have to depend on his own eyes and a small portable telescope.

From the foot of Stairway Alpha to the edge of the Sea was just under fifteen kilometres - or an Earth-equivalent of eight under the low gravity of Rama. Laura Ernst, who had to prove that she lived up to her own standards, set a brisk pace. They stopped for thirty minutes at the mid-way mark, and made the whole trip in a completely uneventful three hours.

It was also quite monotonous, walking forward in the beam of the searchlight through the anechoic darkness of Rama. As the pool of light advanced with them, it slowly elongated into a long, narrow ellipse; this foreshortening of the beam was the only visible sign of progress. If the observers up on the Hub had not given them continual distance checks, they could not have guessed whether they had travelled one kilometre, or five, or ten. They just plodded onwards through the million-year-old night, over an apparently seamless metal surface.

But at last, far ahead at the limits of the now weakening beam, there was something new. On a normal world, - it would have been a horizon; as they approached, they could see that the plain on which they were walking dame to an abrupt stop. They were nearing the edge of the Sea.

'Only a hundred metres,' said Hub Control. 'Better slow down.'

That was hardly necessary, yet they had already done so. It was a sheer straight drop of fifty metres from the level of the plain to that of the Sea - if it was a sea, and not another sheet of that mysterious crystalline material. Although Norton had impressed upon everyone the danger of taking anything for granted in Rama, few doubted that the Sea was really made of ice. But for what conceivable reason was the cliff on the southern shore five hundred metres high, instead of the fifty here?

It was as if they were approaching the edge of the world; their oval of light, cut off abruptly ahead of them, became shorter and shorter. But far out on the curved screen of the Sea their monstrous foreshortened shadows had appeared, magnifying and exaggerating every movement. Those shadows had been their companions every step of the way, as they marched down the beam, but now that they were broken at the edge of the cliff they no longer seemed part of them. They might have been crea-

tures of the Cylindrical Sea, waiting to deal with any intruders into their domain.

Because they were now standing on the edge of a fifty-metre cliff, it was possible for the first time to appreciate the curvature of Rama. But no one had ever seen a frozen lake bent upwards into a cylindrical surface;, that was distinctly unsettling, and the eye did its best to find some other interpretation. It seemed to Dr Ernst, who had once made a study of visual illusions, that half the time she was really looking at a horizontally curving bay, not a surface that soared up into the sky. It required a deliberate effort of will to accept the fantastic truth.

Only in the line directly ahead, parallel to the axis of Rama, was normalcy preserved. In this direction alone was there agreement between vision and logic. Here - for the next few kilometres at least - Rama looked flat, and was flat... And out there, beyond their distorted shadows and the outer limit of the beam, lay the island that dominated the Cylindrical Sea.

'Hub Control,' Dr Ernst radioed, 'please aim your beam at New York.'

The night of Rama fell suddenly upon them, as the oval of light went sliding out to sea. Conscious of the now invisible cliff at their feet, they all stepped back a few metres. Then, as if by some magical stage transformation, the towers of New York sprang into view.

The resemblance to old-time Manhattan was only superficial; this star-born echo of Earth's past possessed its own unique identity. The more Dr Ernst stared at it, the more certain she became that it was not a city at all.

The real New York, like all of Man's habitations, had never been finished; still less had it been designed. This place, however, had an overall symmetry and pattern, though one so complex that it eluded the mind. It had been conceived and planned by some controlling intelligence - and then it had been completed, like a machine devised for some specific purpose. After that, there was no possibility of growth or change.

The beam of the searchlight slowly tracked along those distant towers and domes and interlocked spheres and criss-crossed tubes. Sometimes there would be a brilliant reflection as some flat surface shot the light back towards them; the first time this happened, they were all taken by surprise. It was exactly as. if, over there on that strange island, someone was signalling to them...

But there was nothing that they could see here that was not already shown in greater detail on photographs taken from the Hub. After a few minutes, they called for the light to return to them, and began to walk eastwards

along the edge of the cliff. It had been plausibly theorized that, somewhere, there must surely be a flight of steps, or a ramp, leading down to the Sea. And one crewman, who was a keen sailor, had raised an interesting conjecture.

'Where there's a sea,' Sergeant Ruby Barhes had predicted, 'there must be docks and harbours - and ships. You can learn everything about a culture by studying the way it builds boats.' Her colleagues thought this a rather restricted point of view, but at least it was a stimulating one.

Dr Ernst had almost given up the search, and was preparing to m4e a descent by rope, when Lt Rodrigo spotted the narrow stairway. It could easily have been overlooked in the shadowed darkness below the edge of the cliff, for there was no guard-rail or other indication of its presence. And it seemed to lead nowhere; it ran down the fifty-metre vertical wall at a steep angle, and disappeared below the surface of the Sea.

They scanned the flight of steps with their helmetlights, could see no conceivable hazard, and Dr Ernst got Commander Norton's permission to descend. A minute later, she was cautiously testing the surface of the Sea.

Her foot slithered almost frictionlessly back and forth. The material felt exactly like ice. It was ice.

When she struck it with her hammer, a familiar pattern of cracks radiated from the impact point, and she had no difficulty in collecting as many pieces as she wished. Some had already melted when she held up the sample holder to the light; the liquid appeared to be slightly turbid water, and she took a cautious sniff.

'Is that safe?' Rodrigo called down, with a' trace of anxiety.

'Believe me, Boris,' she answered, 'if there are any pathogens around here that have slipped through my detectors, our insurance policies lapsed a week ago.

But Boris had a point. Despite all the tests that had been carried out, there was a very slight risk that this substance might be poisonous, or might carry some unknown disease. In normal circumstances, Dr Ernst would not have taken even this minuscule chance. Now, however, time was short and the stakes were enormous. If it became necessary to quarantine Endeavour, that would be a very small price to pay for her cargo of knowledge.

'It's water, but I wouldn't care to drink it - it smells like an algae culture that's gone bad. I can hardly wait to get it to the lab.'

'Is the ice safe to walk on?'

'Yes, solid as a rock.'

'Then we can get to New York.'

'Can we, Pieter? Have you ever tried to walk across four kilometres of ice?'

'Oh - I see what you mean. Just imagine what Stores would say, if we asked for a set of skates! Not that many of us would know how to use them, even if we had any aboard.'

'And there's another problem,' put in Boris Rodrigo. 'Do you realize that the temperature is already above freezing? Before long, that ice is going to melt. How many spacemen can swim four kilometres? Certainly not this one...'

Dr Ernst rejoined them at the edge of the cliff, and held up the small sample bottle in triumph.

'It's a long walk for a few cc's of dirty water, but it may teach us more about Rama than anything we've found so far. let's head for home.'

They turned towards the distant lights of the Hub, moving with the gentle, loping strides which had proved the most comfortable means of walking under this reduced gravity. Often they looked back, drawn by the hidden enigma of the island out there in the centre of the frozen sea.

And just once, Dr Ernst thought she felt the faint suspicion of a breeze against her cheek.

It did not come again, and she quickly forgot all about it.

CHAPTER SIXTEEN - Kealakekua

'As you know perfectly well, Dr Perera,' said Ambassador Bose in a tone of patient resignation, 'few of us share your knowledge of mathematical meteorology. So please take pity on our ignorance.'

'With pleasure,' answered the exobiologist, quite unabashed. 'I can explain it best by telling you what is going to happen inside Rama - very soon.

'The temperature is now about to rise, as the solar heat pulse reaches the interior. According to the latest information I've received, it's already above freezing point. The Cylindrical Sea will soon start to thaw; and unlike bodies of water on Earth, it will melt from the bottom

upwards. That may produce some odd effects; but I'm much more concerned with the atmosphere.

'As it's heated, the air inside Rama will expand - and will attempt to rise towards the central axis. And this is the problem. At ground level, although it's apparently stationary, it's actually sharing the spin of Rama - over eight hundred kilometres an hour. As it rises towards the axis it will try to retain that speed - and it won't be able to do so, of course. The result will be violent winds and turbulence; I estimate velocities of between two and three hundred kilometres an hour.

'Incidentally, very much the same thing occurs on Earth. The heated air at the Equator - which shares the Earth's sixteen-hundred-kilometres-an-hour spin - runs into the same problem when it rises and flows north and south.'

'Ah, the Trade Winds! I remember that from my geography lessons'

'Exactly, Sir Robert. Rama will have Trade Winds, with a vengeance. I believe they'll last only a few hours, and then spine kind of equilibrium will be restored. Meanwhile, I should advise Commander Norton to evacuate - as soon as possible. Here is the message I propose sending.'

With a little imagination, Commander Norton told himself, he could pretend that this was an improvised night camp at the foot of some mountain in a remote region of Asia or America. The clutter of sleeping pads, collapsible chain and tables, portable power plant, lighting equipment, electrosan toilets, and miscellaneous scientific apparatus would not have looked out of place on Earth - especially as there were men and women working here without life-support systems.

Establishing Camp Alpha had been very hard work, for everything had had to be man-handled through the chain of airlocks, sledded down the slope from the Hub, and then retrieved and unpacked. Sometimes, when the braking parachutes had failed, a consignment had ended up a good kilometre away out on the plain: Despite this, sexual crew members had asked permission to make the ride; Norton had firmly forbidden it. In an emergency, however, he might be prepared to reconsider the ban.

Almost all this equipment would stay here, for the labour of carrying it back was unthinkable - in fact, impossible. There were times when Commander Norton felt an irrational shame at leaving so much human litter in this strangely immaculate place. When they finally departed, he was prepared to sacrifice some of their precious time to leave everything in good order. Improbable though it was, perhaps millions of years hence, when Rama shot

through some other star system, it might have visitors again. He would like to give them a good impression of Earth.

Meanwhile, he had a rather more immediate problem. During the last twenty-four hours he had received almost identical messages from both Mars and Earth. It seemed an odd coincidence; perhaps they had been commiserating with each other, as wives who lived safely on different planets were liable to do under sufficient provocation. Rather pointedly, they had reminded him that even though he was now a great hero, he still had family responsibilities.

The Commander picked up a collapsible chair, and walked out of the pool of light into the darkness surrounding the camp. It was the only way he could get any privady, and he could also think better away from the turmoil. Deliberately turning his back on the organized confusion behind him, he began to speak into the recorder slung around his neck.

'Original for personal file, dupes to Mars and Earth. Hello, darling - yes, I know I've been a lousy correspondent, but I haven't been aboard ship for a week. Apart from a skeleton crew, we're all camping inside Rama, at the foot of the stairway we've christened Alpha.

'I have three parties out now, scouting the plain, but we've made disappointingly slow progress, because everything has to be done on foot. If only we had some means of transport! I'd be very happy to settle for a few electric bicycles ... they'd be perfect for the job.

'You've met my medical officer, Surgeon-Commander Ernst-' He paused uncertainly; Laura had met one of his wives, but which? Better cut that out--

Erasing the sentence, he began again.

'My MO, Surgeon-Commander Ernst, led the first group to reach the Cylindrical Sea, fifteen kilometres from here. She found that it was frozen water, as we'd expected - but you wouldn't want to drink it. Dr Ernst says it's a dilute organic soup, containing traces of almost any carbon compound you care to name, as well as phosphates and nitrates and dozens of metallic salts. There's not the slightest sign of life - not even any dead microorganisms. So we still know nothing about the biochemistry of the Ramans ... though it was probably not wildly different from ours.

Something brushed lightly against his hair; he had been too busy to get it cut, and would have to do something about that before he next put on a space-helmet ...

'You've seen the viddies of Paris and the other towns

we've explored on this side of the Sea ... London, Rome, Moscow. It's impossible to believe that they were ever built for anything to live in. Paris looks like a giant storage depot. London is a collection of cylinders linked together by pipes connected to what are obviously pumping stations. Everything is sealed up, and there's no way of finding what's inside without explosives or lasers. We won t try these until there are no alternatives.

'As for Rome and Moscow-'

'Excuse me, Skipper. Priority from Earth.'

What now? Norton asked himself. Can't a man get a few minutes to talk to his families?

He took the message from the Sergeant, and scanned it quickly, just to satisfy himself that it was not immediate. Then he read it again, more slowly.

What the devil was the Rama Committee? And why had he never heard of it? He knew that all sorts of associations, societies, and professional groups - some serious, some completely crackpot - had been trying to get in touch with him; Mission Control had done a good job of protection, and would not have forwarded this message unless it was considered important.

'Two-hundred-kilometre winds - probably sudden onset' - well, that was something to think about. But it was hard to take it too seriously, on this utterly calm night; and it would be ridiculous to run away like frightened mice, when they were just starting effective exploration.

Commander Norton lifted a hand to brush aside his hair, which had somehow fallen into his eyes again. Then he froze, the gesture uncompleted.

He had felt a trace of wind, several times in the last hour. It was so slight that he had completely ignored it; after all, he was the commander of a spaceship, not a sailing ship. Until now the movement of air had not been of the slightest professional concern. What would the long-dead captain of that earlier Endeavour have done in a situation such as this?

Norton had asked himself that question at every moment of crisis in the last few years. It was his secret, which he had never revealed to anyone. And like most of the important things in life, it had come about quite by accident.

He had been captain of Endeavour for several months before he realized that it was named after one of the most famous ships in history. True, during the last four hundred years there had been a dozen Endeavours of sea and two of space, but the ancestor of them all was the 370-ton

Whitby collier that Captain James Cook, RN, had sailed round the world between 1768 and 1771.

With a mild interest that had quickly turned to an absorbing curiosity - almost an obsession - Norton had begun to read everything he could find about Cook. He was now probably the world's leading authority on the greatest explorer of all time, and knew whole sections of the Journals by heart.

It still seemed incredible that one man could have done so much, with such primitive equipment. But Cook had been not only a supreme navigator, but a scientist and - in an age of brutal discipline - a humanitarian. He treated his own men with kindness, which was unusual; what was quite unheard of was that he behaved in exactly the same way to the often hostile savages in the new lands he discovered.

It was Norton's private dream, which he knew he would never achieve, to retrace at least one of Cook's voyages around the world. He had made a limited but spectacular start, which would certainly have astonished the Captain, when he once flew a polar orbit directly above the Great Barrier Reef. It had been early morning on a clear day, and from four hundred kilometres up he had had a superb view of that deadly wall of coral, marked by its line of white foam along the Queensland coast.

He had taken just under five minutes to travel the whole two thousand kilometres of the Reef. In a single glance he could span weeks of perilous voyaging for that first Endeavour. And through the telescope, he had caught a glimpse of Cooktown and the estuary where the ship had been dragged ashore for repairs, after her near-fatal encounter with the Reef.

A year later, a visit to the Hawaii Deep-Space Tracking Station had given him an even more unforgettable experience. He had taken the hydrofoil to Kealakekua Bay, and as he moved swiftly past the bleak volcanic cliffs, he felt a depth of emotion that had surprised and even disconcerted him. The guide had led his group of scientists, engineers and astronauts past the glittering metal pylon that had replaced the earlier monument, destroyed by the Great Tsunami of '68. They had walked on for a few more yards across black, slippery lava to the small plaque at the water's edge. Little waves were breaking over it, but Norton scarcely noticed them as he bent down to read the words:

NEAR THIS SPOT

CAPTAIN JAMES COOK

WAS KILLED

14 FEBRUARY, 1779

ORIGINAL TABLET DEDICATED 28 AUGUST, 1928

BY COOK SESQUICENTENNIAL COMMISSION.

REPLACED BY TRICENTENNIAL COMMISSION

14 FEBRUARY, 2079

That was years ago, and a hundred million kilometres away. But at moments like this, Cook's reassuring presence seemed very close. In the secret depths of his mind, he would ask: 'Well, Captain - what is your advise?' It was a little game he played, on occasions when there were not enough facts for sound judgement, and one had to rely on intuition. That had been part of Cook's genius; he always made the right choice - until the very end, at Kealakekua Bay.

The Sergeant waited patiently, while his Commander stared silently out into the night of Rama. It was no longer unbroken, for at two spots about four kilometres away, the faint patches of light of exploring parties could be clearly seen.

In an emergency, I can recall them within the hour, Norton told himself. And that, surely, should be good enough.

He turned to the Sergeant, 'Take this message. Rama Committee, care of Spacecom. Appreciate your advice and will take precautions. Please specify meaning of phrase "sudden onset". Respectfully, Norton, Commander, Endeavour.'

He waited until the Sergeant had disappeared towards the blazing lights of the camp, then switched on his recorder again. But the train of thought was broken, and he could not get back into the mood. The letter would have to wait for some other time.

It was not often that Captain Cook came to his aid when he was neglecting his duty. But he suddenly remembered how rarely and briefly poor Elizabeth Cook had seen her husband in sixteen years of married life. Yet she had borne him six children - and outlived them all.

His wives, never more than ten minutes away at the speed of light, had nothing to complain about...

CHAPTER SEVENTEEN - Spring

During the first 'nights' on Rama, it had not been easy to sleep. The darkness and the mysteries it concealed were

oppressive, but even more unsettling was the silence. Absence of noise is not a natural condition; all human senses require some input. If they are deprived of it, the mind manufactures its own substitutes.

And so many sleepers had complained of strange noises - even of voices - which were obviously illusions, because those awake had heard nothing. Surgeon-Commander Ernst had prescribed a very simple and effective cure; during the sleeping period, the camp was now lulled by gentle, unobtrusive background music.

This night, Commander Norton found the cure inadequate. He kept straining his ears into the darkness, and he knew what he was listening for. But though a very faint breeze did caress his face from time to time, there was no sound that could possibly be taken for that of a distant, rising wind. Nor did either of the exploring parties report anything unusual.

At least, around Ship's midnight, he went to sleep. There was always a man on watch at the communications console, in case of any urgent messages. No other precautions seemed necessary.

Not even a hurricane could have created the sound that did wake him, and the whole camp, in a single instant. It seemed that the sky was falling, or that Rama had split open and was tearing itself apart. First there was a rending crack, then a long-drawn-out series of crystalline crashes like a million glass-houses being demolished. It lasted for minutes, though it seemed like hours; it was still continuing, apparently moving away into the distance, when Norton got to the message centre.

'Hub Control! What's happened?'

'Just a moment, Skipper. It's over by the Sea. We're getting the light on it.'

Eight kilometres overhead, on the axis of Rama, the searchlight began to swing its beam out across the plain. It reached the edge of the Sea, then started to track along it, scanning around the interior of the world. A quarter of the way round the cylindrical surface, it stopped.

Up there in the sky - or what the mind still persisted in calling the sky - something extraordinary was happening. At first, it seemed to Norton that the Sea was boiling. It was no longer static and frozen in the grip of an eternal winter; a huge area, kilometres across, was in turbulent movement. And it was changing colour; a broad band of white was marching across the ice.

Suddenly a slab perhaps a quarter of a kilometre on a side began to tilt upwards like an opening door. Slowly and majestically, it reared into the sky, glittering and

sparkling in the beam of the searchlight. Then it slid back and vanished underneath the surface, while a tidal wave of foaming water raced outwards in all directions from its point of submergence.

Not until then did Commander Norton fully realize what was happening. The ice was breaking up. All these days and weeks, the Sea had been thawing, far down in the depths. It was hard to concentrate because of the crashing roar that still filled the world and echoed round the sky, but he tried to think of a reason for so dramatic a convulsion. When a frozen lake or river thawed on Earth, it was nothing like this...

But of course! It was obvious enough, now that it had happened. The Sea was thawing from beneath as the solar heat seeped through the hull of Rama. And when ice turns into water, it occupies less volume ...

So the Sea had been sinking below the upper layer of ice, leaving it unsupported. Day by day the strain bad been building up; now the band of ice that encircled the equator of Rama was collapsing, like a bridge that had lost its central pier. It was splintering into hundreds of floating islands, that would<crash and jostle into each other until they too melted. Norton's blood ran suddenly cold, when he remembered the plans that were being made to reach New York by sledge...

The tumult was swiftly subsiding; a temporary stalemate had been reached in the war between ice and water. In a few hours, as the temperature continued to rise, the water would win and the last vestiges of ice would disappear. But in the long run, ice would be the victor, as Rama rounded the sun and set forth once more into the interstellar night.

Norton remembered to start breathing again; then he called the party nearest the Sea. To his relief, Lieutenant Rodrigo answered at once. No, the water hadn't reached them. No tidal wave had come sloshing over the edge of the cliff. 'So now we know,' he added very calmly, 'why there is a cliff.' Norton agreed silently; but that hardly explains, he thought to himself, why the cliff on the southern shore is ten times higher...

The Hub searchlight continued to scan round the world. The awakened Sea was steadily calming, and the boiling white foam no longer raced outwards from capsizing ice-floes. In fifteen minutes, the main disturbance was over.

But Rama was no longer silent; it had awakened from its sleep, and ever and again there came the sound of grinding ice as one berg collided with another.

Spring had been a little late, Norton told himself, but

winter had ended.

And there was that breeze again, stronger than ever. Rama had given him enough warnings; it was time to go.

As he neared the halfway mark, Commander Norton once again felt gratitude to the darkness that concealed the view above - and below. Though he knew that more than ten thousand steps still lay ahead of him, and could picture the steeply ascending curve in his mind's eye, the fact that he could see only a small portion of it made the prospect more bearable.

This was his second ascent, and he had learned from his mistakes on the first. The great temptation was to dumb too quickly in this low gravity; every step was so easy that it was very hard to adopt a slow, plodding rhythm. But unless one did this, after the first few thousand steps strange aches developed in the thighs and calves. Muscles that one never knew existed started to protest, and it was necessary to take longer and longer periods of rest. Towards the end he had spent more time resting than climbing, and even then it was not enough. He had suffered painful leg-cramps for the next two days, and would have been almost incapacitated had he not been back in the zero-gravity environment of the ship.

So this time he had started with almost painful slowness, moving like an old man. He had been the last to leave the plain, and the others were strung out along the half-kilometre of stairway above him; he could see their lights moving up the invisible slope ahead.

He felt sick at heart at the failure of his mission, and even now hoped that this was only a temporary retreat. When they reached the Hub, they could wait until any atmospheric disturbances had ceased. Presumably, it would be a dead calm there, as at the centre of a cyclone, and they could wait out the expected storm in safety.

Once again, he was jumping to conclusions, drawing dangerous analogies from Earth. The meteorology of a whole world, even under steady-state conditions, was a matter of enormous complexity. After several centuries of study, terrestrial weather-forecasting was still not absolutely reliable. And Rama was not merely a completely novel system; it was also undergoing rapid changes, for the temperature had risen several degrees in the last few hours. Yet still there was no sign of the promised hurricane, though there had been a few feeble gusts from apparently random directions.

They had now climbed five kilometres, which in this low and steadily diminishing gravity was equivalent to less than two on Earth. At the third level, three kilometres from the axis, they rested for an hour, taking light refreshments and massaging leg muscles. This was the last

point at which they could breathe in comfort; like old-time Himalayan mountaineers, they had left their oxygen supplies here, and now put them on for the final ascent.

An hour later, they had reached the top of the stairway - and the beginning of the ladder. Ahead lay the last, vertical kilometre, fortunately in a gravity field only a few per cent of Earth's. Another thirty-minute rest, a careful check of oxygen, and they were ready for the final lap.

Once again, Norton made sure that all his men were safely ahead of him, spaced out at twenty-metre intervals along the ladder. From now on, it would be a slow, steady haul, extremely boring. The best technique was to empty the mind of all thoughts and to count the rungs as they drifted by - one hundred, two hundred, three hundred, four hundred...

He had just reached twelve hundred and fifty when he suddenly realized that something was wrong. The light shining on the vertical surface immediately in front of his eyes was the wrong colour - and it was much too bright.

Commander Norton did not even have time to check his ascent, or to call a warning to his men. Everything happened in less than a second.

In a soundless concussion of light, dawn burst upon Rama.

CHAPTER EIGHTEEN - Dawn

The light was so brilliant that for a full minute Norton had to keep his eyes clenched tightly shut. Then he risked opening them, and stared through barely-parted lids at the wall a few centimetres in front of his face. He blinked several times, waited for the involuntary tears to drain away, and then turned slowly to behold the dawn.

He could endure the sight for only a few seconds; then he was forced to close his eyes again. It was not the glare that was intolerable - he could grow accustomed to that - but the awesome spectacle of Rama, now seen for the first time in its entirety.

Norton had known exactly what to expect; nevertheless the sight had stunned him. He was seized by a spasm of uncontrollable trembling; his hands tightened round the rungs of the ladder with the violence of a drowning man clutching at a lifebelt. The muscles of his forearms began to knot, yet at the same time his legs - already fatigued by hours of steady climbing - seemed about to give way. If it had not been for the low gravity, he might have fallen.

Then his training took over, and he began to apply the first remedy for panic. Still keeping his eyes closed and trying to forget the monstrous spectacle around him, he started to take deep, long breaths, filling his lungs with oxygen and washing the poisons of fatigue out of his system.

Presently he felt much better, but he did not open his eyes until he had performed one more action. It took a major effort of will to force his right hand to open - he had to talk to it like a disobedient child - but presently he manoeuvred it down to his waist, unclipped the safety belt from his harness, and hooked the buckle to the nearest rung. Now, whatever happened, he could not fall.

Norton took several more deep breaths; then - still keeping his eyes closed - he switched on his radio. He hoped his voice sounded calm and authoritative as he called: 'Captain here. Is everyone OK?'

As he checked off the names one by one, and received answers - even if somewhat tremulous ones - from everybody, his own confidence and self-control came swiftly - back to him. All his men were safe, and were looking to him for leadership. He was the commander once more.

'Keep your eyes closed until you're quite sure you can take it,' he called. 'The view is - overwhelming. If anyone finds that it's too much, keep on climbing without looking back. Remember, you'll soon be at zero gravity, so you can't possibly fall.'

It was hardly necessary to point out such an elementary fact to trained spacemen, but Norton had to remind himself of it every few seconds. The thought of zero-gravity was a kind of talisman, protecting him from harm. Whatever his eyes told him, Rama could not drag him down to destruction on the plain eight kilometres below.

It became an urgent matter of pride and self-esteem that he should open his eyes once more and look at the world around him. But first, he had to get his body under control.

He let go of the ladder with both hands, and hooked his left arm under a rung. Clenching and unclenching his fats, he waited until the muscle cramps had faded away; then, when he felt quite comfortable, he opened his eyes and slowly turned to face Rama.

His fist impression was one of blueness. The glare that filled the sky could not have been mistaken for sunlight; it might have been that of an electric arc. So Rama's sun, Norton told himself,' must be hotter than ours. That

should interest the astronomers...

And now he understood the purpose of those mysterious trenches, the Straight Valley and its five companions; they were nothing less than gigantic strip-lights. Rama had six linear suns, symmetrically ranged around its interior. From each, a broad fan of light was aimed across the central axis, to shine upon the far side of the world. Norton wondered if they could be switched alternately to produce a cycle of light and darkness, or whether this was a planet of perpetual day.

Too much staring at those blinding bars of light had made his eyes hurt again; he was not sorry to have a good excuse to close them for a while. It was not until then, when he had almost recovered from this initial visual shock, that he was able to devote himself to a much more serious problem.

Who or what, had switched on the lights of Rama?

This world was sterile, by the most sensitive tests that man could apply to it. But now something was happening that could not be explained by the action of natural forces. There might not be life here, but there could be consciousness, awareness; robots might be waking after a sleep of aeons. Perhaps this outburst of light was an unprogrammed, random spasm - a last dying gasp of machines that were responding wildly to the warmth of a new sun, and would soon lapse again into quiescence, this time for ever.

Yet Norton could not believe such a simple explanation. Bits of the jigsaw puzzle were beginning to fall into place, though many were still missing. The absence of all signs of wear, for example - the feeling of nearness, as if Rama had just been created ...

These thoughts might have inspired fear, even terror. Somehow, they did nothing of the sort. On the contrary, Norton felt a sense of exhilaration - almost of delight. There was far more here to discover than they had ever dared to hope. 'Wait,' he said to himself, 'until the Rama Committee hears about this!'

Then, with a calm determination, he opened his eyes again and began a careful inventory of everything he saw.

First, he had to establish some kind of reference system. He was looking at the largest enclosed space ever seen by man, and needed a mental map to find his way around it.

The feeble gravity was very little help, for with an effort of will he could switch Up and Down. in any direction he pleased. But some directions were psychologically

dangerous; whenever his mind skirted these, he had to vector it hastily away.

Safest of all was to imagine that he was at the bowl-shaped bottom of a gigantic well, sixteen kilometres wide and fifty deep. The advantage of this image was that there could be no danger of falling further, nevertheless, it had some serious defects.

He could pretend that the scattered towns and cities, and the differently coloured and textured areas, were all securely fixed to the towering walls. The various complex structures that could be seen hanging from the dome overhead were perhaps no more disconcerting than the pendent candelabra in some great concert-ball on Earth. What was quite unacceptable was the Cylindrical Sea

There it was, halfway up the well-shaft - a band of water, wrapped completely round it, with no visible means of support. There could be no doubt that it was water; it was a vivid blue, flecked with brilliant sparkles from the few remaining ice-floes. But a vertical sea forming a complete circle twenty kilometres up in the sky was such an unsettling phenomenon that after a while he began to seek an alternative.

That was when his mind switched the scene through ninety degrees. Instantly, the deep well became a long 'tunnel, capped at either end. 'Down' was obviously in the direction of the ladder and the stairway he had just ascended; and now with this perspective, Norton was at last able to appreciate the true vision of the architects who had built this place.

He was clinging to the face of a curving sixteen-kilometre-high cliff, the upper half of which overhung completely until it merged into the arched roof of What was now the sky. Beneath him, the ladder descended more than five hundred metres, until it ended at the first ledge or terrace. There the stairway began, continuing almost vertically at first in this low-gravity regime, then slowly becoming less and less steep until, after breaking at five more platforms, it reached the distant plain. For the first two or three kilometres he could see the individual steps, but thereafter they had merged into a continuous band.

The downward swoop of that immense stairway was so overwhelming that it was impossible to appreciate its true scale. Norton had once flown round Mount Everest, and had been awed by its size. He reminded himself that this stairway was as high as the Himalayas, but the comparison was meaningless.

And no comparison at all was possible with the other two stairways, Beta and Gamma, which slanted up into the sky and then curved far out over his head. Norton had now acquired enough confidence to lean back and

glance up at them - briefly. Then he tried to forget that they were there...

For too much thinking along those lines evoked yet a third image of Rama, which he was anxious to avoid at all costs. This was the viewpoint that regarded it once again as a vertical cylinder or well - but now he was at the top, not the bottom, like a fly crawling upside down on a domed ceiling, with a fifty-kilometre drop immediately below. Every time Norton found this image creeping up on him, it needed all his willpower not to cling to the ladder again in mindless panic.

In time, he was sure, all these fears would ebb. The wonder and strangeness of Rama would banish its terrors, at least for men who were trained to face the realities of space. Perhaps no one who had never left Earth, and had never seen the stars all around him, could endure these vistas. But if any men could accept them, Norton told himself with grim determination, it would be the captain and crew of Endeavour.

He looked at his chronometer. This pause had lasted only two minutes, but it had seemed a lifetime. Exerting barely enough effort to overcome his inertia and the fading gravitational field, he started to pull himself slowly up the last hundred metres of the ladder. Just before he entered the airlock and turned his back upon Rama, he made one final swift survey of the interior.

It had changed, even in the last few minutes; a mist was rising from the Sea. For the first few hundred metres the ghostly white columns were tilted sharply forward in the direction of .Rama's spin; then they started to dissolve in a swirl of turbulence, as the uprushing air tried to jettison its excess velocity. The Trade Winds of this cylindrical world were beginning to etch their patterns in its sky; the first tropical storm in unknown ages was about to break.

CHAPTER NINE TEEN - A Warning from Mercury

It was the first time in weeks that every member of the Rama Committee had made himself available. Professor Solomons had emerged from the depths of the Pacific, where he had been studying mining operations along the mid-ocean trenches. And to nobody's surprise, Dr Taylor had reappeared, now that there was at least a possibility that Rama held something more newsworthy than lifeless artifacts.

The Chairman had fully expected Dr Carlisle Perera to be even more dogmatically assertive than usual, now that his prediction of a Raman hurricane had been confirmed. To His Excellency's great surprise, Perera was remarkably subdued, and accepted the congratulations of his colleagues in a manner as near to embarrassment as

he was ever likely to achieve.

The exobiologist, in fact, was deeply mortified. The spectacular break-up of the Cylindrical Sea was a much more obvious phenomenon than the hurricane winds - yet he had completely overlooked it. To have remembered that hot air rises, but to have forgotten that hot ice contracts, was not an achievement of which he could be very proud. However, he would soon get over it, and revert to his normal Olympian self-confidence.

When the Chairman offered him the floor, and asked what further climatic changes he expected, he was very careful to hedge his bets.

'You must realize,' he explained, 'that the meteorology of a world as strange as Rama may have many other surprises. But if my calculations are correct, there will be no further storms, and conditions will soon be stable. There will be a slow temperature rise until perihelion - and beyond - but that won't concern us, as Endeavour will have had to leave long before then.'

'So it should soon be safe to go back inside?'
'Er - probably. We should certainly know in forty-eight hours.'

'A return is imperative,' said the Ambassador for Mercury. 'We have to learn everything we possibly can about Rama. The situation has now changed completely.'

'I think we know what you mean, but would you care to elaborate?'

'Of course. Until now, we have assumed that Rama is lifeless - or at any rate uncontrolled. But we can no longer pretend that it is a derelict. Even if there are no life-forms aboard, it may be directed by robot mechanisms, programmed to carry out 'some mission - perhaps one highly disadvantageous to us. Unpalatable though it may be, we must consider the question of self-defence.'

There was a babble of protesting voices, and the Chairman had to hold up his hand to restore order.

'Let His Excellency finish!' he pleaded. 'Whether we like the idea or not, it should be considered seriously.'

'With all due respect to the Ambassador,' said Dr Conrad Taylor in his most disrespectful voice, 'I think we can rule out as naïve the fear of malevolent intervention. Creatures as advanced as the Ramans must have correspondingly developed morals. Otherwise, they would have destroyed themselves - as we nearly did in the twentieth century. I've made that quite clear in my new book Ethos and Cosmos. I hope you received your copy.

'Yes, thank you, though I'm afraid the pressure of other matters has not allowed me to read beyond the introduction. However, I'm familiar with the general thesis. We may have no malevolent intentions towards an ant-heap. But if we want to build a house on the same site ...

'This is as bad as the Pandora Party! It's nothing less than interstellar xenophobia!'

'Please, gentlemen! This is getting us nowhere. Mr Ambassador, you still have the floor.'

The Chairman glared across three hundred and eighty thousand kilometres of space at Conrad Taylor, who reluctantly subsided, like a volcano biding its tune.

'Thank you,' said the Ambassador for Mercury. 'The danger may be unlikely, but where the future of the human race is involved, we can take no chances. And, if I may say so, we Hermians may be particularly concerned. We may have more cause for alarm than anyone else.'

Dr Taylor snorted audibly, but was quelled by another glare from the Moon.

'Why Mercury, more than any other planet?' asked the Chairman.

'Look at the dynamics of the situation. Rama is already inside our orbit. It is only an assumption that it will go round the sun and head on out again into space. Suppose it carries out a braking manoeuvre? If it does so, this will be at perihelion, about thirty days from now. My scientists tell rue that if the entire velocity change is carried out there, Rama will end up in a circular orbit only twenty-five million kilometres from the sun. From here, it could dominate the solar system.'

For a long time nobody - not even Conrad Taylor - spoke a word. Ml the members of the Committee were marshalling their thoughts about those difficult people the Hermians, so ably represented here by their Ambassador.

To most people, Mercury was a fairly good approximation of Hell; at least, it would do until something worse came along. But the Hermians were proud of their bizarre planet, with its days longer than its years, its double sunrises and sunsets, its rivers of molten metal ... By comparison, the Moon and Mars had been almost trivial challenges. Not until men landed on Venus (if they even did) would they encounter an environment - more hostile than that of Mercury.

And yet this world had turned out to be, in many ways, the key to the solar system. This seemed obvious in retrospect, but the Space Age had been almost a century old before the fact was realized. Now the Hermians never let anyone forget it.

Long before men reached the planet, Mercury's abnormal density hinted at the heavy elements it contained; even so, its wealth was still a source of astonishment, and had postponed for a thousand years any fears that the key metals of human civilization would be exhausted. And these treasures were in the best possible place, where the power of the Sun was ten times greater than on frigid Earth.

Unlimited energy - unlimited metal; that was Mercury. Its great magnetic launchers could catapult manufactured products to any point in the solar system. It could also export energy, in synthetic transuranium isotopes or pure radiation. It had even been proposed that Hermian lasers would one day thaw out gigantic Jupiter, but this idea had not been well received on the other worlds. A technology that could cook Jupiter had too many tempting possibilities for interplanetary blackmail.

That such a concern had ever been expressed said a good deal about the general attitude towards the Hermians. They were respected for their toughness and engineering skills, and admired for the way in which they had conquered so fearsome a world. But they were not liked, and still less were they completely trusted.
- At the same time, it was possible to appreciate their point of view. The Hermians, it was often joked, sometimes behaved as if the Sun was their, personal property. They were bound to it in an intimate love-hate relationship - as the Vikings had once been linked to the sea, the Nepalese to the Himalayas, the Eskimos to the Tundra. They would be most unhappy if something came between them and the natural force that dominated and controlled their lives.

At last, the Chairman broke the long silence. He still remembered the sun of India, and shuddered to contemplate the sun of Mercury. So he took the Hermians very seriously indeed, even though he considered them uncouth technological barbarians.

'I think there is some merit in your argument, Mr Ambassador,' he said slowly. 'Have you any proposals?'

'Yes, sir. Before we know what action to take, we must have the facts. We know the geography of Rama - if one can use that term - but we have no idea of its capabilities. And the key to the whole problem is this: does Rama have a propulsion system? Can it change orbit? I'd be very interested in Dr Perera's views.'

'I've given the subject a good deal of thought,' answered the exobiologist. 'Of course, Rama must have been given its original impetus by some launching device, but that could have been an external booster. If it does have onboard propulsion, we've found no trace of it. Certainly there are no rocket exhausts, or anything similar, anywhere on the outer shell.'

'They could be hidden.'

'True, but there would seem little point in it. And where are the propellant tanks, the energy sources? The main hull is solid - we've checked that with seismic surveys. The cavities in the northern cap are all accounted for by the airlock systems.

'That leaves the southern end of Rama, which Commander Norton has been unable to reach, owing to that ten-kilometre-wide band of water. There are all sorts of curious mechanisms and structures up on the South Pole - you've seen the photographs. What they are is anybody's guess.

'But I'm reasonably sure of this. If Rama does have a propulsion system, it's something completely outside our present knowledge. In fact, it would have to be the fabubus "Space Drive" people have been talking about for two hundred years.

'You wouldn't rule that out?'

'Certainly not. If we can prove that Rama has a Space Drive - even if we learn nothing about its mode of operation - that would be a major discovery. At least we'd know that such a thing is possible.'

'What is a Space Drive?' asked the Ambassador for Earth, rather plaintively.

'Any kind of propulsion system, Sir Robert, that doesn't work on the rocket principle. Anti-gravity - if it is possible - would do very nicely. At present, we don't know where to look for such a drive, and most scientists doubt if it exists.'

'It doesn't,' Professor Davidson interjected. 'Newton settled that. You can't have action without reaction. Space Drives are nonsense. Take it from me.'

'You may be right,' Perera replied with unusual blandness. 'But if Rama doesn't have a Space Drive, it has no drive at all. There's simply no room for a conventional propulsion system, with its enormous fuel tanks.'

'It's hard to imagine a whole world being pushed around,' said Dennis Solomons. "What would happen to

the objects inside it? Everything would have to be bolted down. Most inconvenient.'

'Well, the acceleration would probably be very low. The biggest problem would be the water in the Cylindrical Sea. How would you stop that from...'

Perera's voice suddenly faded away, and his eyes glazed over. He seemed to be in the throes of an incipient epileptic fit, or even a heart attack. His colleagues looked at him in alarm; then he made a sudden recovery, banged his fist on the table and shouted: 'Of course! That explains everything! The southern cliff - now it makes sense!'

'Not to rue,' grumbled the Lunar Ambassador, speaking for all the diplomats present.

'Look at this longitudinal cross-section of Rama,' Perera continued excitedly, unfolding his 'map. 'Have you got your copies? The Cylindrical Sea is enclosed between two cliffs, which completely circle the interior of Rama. The one on the north is only fifty metres high. The southern one, on the other hand, is almost half a kilometre high. Why the big difference? No one's been able to think of a sensible reason.

'But suppose Rama is able to propel itself - accelerating so that the northern end is forward. The water in the Sea would tend to move back; the level at the south would rise - perhaps hundreds of metres. Hence the cliff. Let's see-'

Perera started scribbling furiously. After an astonishingly short time - it could not have been more than twenty seconds - he looked up in triumph.-

'Knowing the height of those cliffs, we can calculate the maximum acceleration Rama can take. If it was more than two per cent of a gravity, the Sea would slosh over into the southern continent.'

'A fiftieth of a gee? That's not very much.'

'It is - for a mass of ten million megatons. And it's all you need for astronomical manoeuvring.'

'Thank you very much, Dr Perera,' said the Hermian Ambassador. 'You've given us a lot to think about. Mr Chairman - can we impress on Commander Norton the importance of looking at the South Polar region?'

'He's doing his best. The Sea is the obstacle, 'of course. They're trying to build some kind of raft - so that they can at least reach New York.'

'The South Pole may be even more important. Mean-

while, I am going to bring these matters to the attention of the General Assembly. Do I have your approval?'

There were no objections, not even from Dr Taylor. But just as the Committee members were about to switch out of circuit, Sir Lewis raised his hand.

The old historian very seldom spoke; when he did, everyone listened.

'Suppose we do find that Rama is - active - and has these capabilities. There is an old saying in military affairs that capability does not imply intention.'

'How long should we wait to find what its intentions are?' asked the Hermian. 'When we discover them, it may be far too bate.'

'It is already too late. There is nothing we can do to affect Rama. Indeed, I doubt if there ever was.'

'I do not admit that, Sir Lewis. There are many things we can do - if it proves necessary. But the time is desperately short. Rama is a cosmic egg, being warmed by the fires of the sun. It may hatch at any moment.'

The Chairman of the Committee looked at the Ambassador for Mercury in frank astonishment. He bad seldom been so surprised in his diplomatic career.

He would never have dreamed that a Hermian was capable of such a poetic flight of imagination.

CHAPTER TWENTY - Book of Revelation

When one of his crew called him 'Commander', or, worse still 'Mister Norton', there was always something serious afoot. He could not recall that Boris Rodrigo had ever before addressed him in such a fashion, so this must be doubly serious. Even in normal times, Lieut-Commander Rodrigo was a very grave and sober person.

'What's the problem, Boris?' he asked when the cabin door closed behind them.

'I'd like permission, Commander, to use Ship Priority for a direct message to Earth.'

This was unusual, though not unprecedented. Routine 'signals went to the nearest 'planetary relay - at the moment, they were working through Mercury - and even though the transit time was only a matter of minutes, it was often five or six hours before a message arrived at the desk of the person for whom it was intended. Ninety-nine per cent of the time, that was quite good enough; but in an emergency more direct, and much more expensive, channels could be employed, at the captain's discretion.

'You know, of course, that you have to give me a good reason. All our available bandwidth is already clogged with data transmissions. Is this a personal emergency?'

'No, Commander. It is much more important than that. I want to send a message to the Mother Church.'

Uh-uh, said Norton to himself. How do I handle this?

'I'd be glad if you'll explain.'

It was not mere curiosity that prompted Norton's request - though that was certainly' present. If be gave Boris the priority he asked, he would have to justify his action.

The calm, blue eyes stared into his. He had never known Boris to lose control, to be other than completely self-assured. All the Cosmo-Christers were bike this; it was one of the benefits of their faith, and it helped to make them good spacemen. Sometimes, however, their unquestioning certainty was just a little annoying to those unfortunates who had not been vouchsafed the Revelation.

'It concerns the purpose of Rama, Commander. I believe I have discovered it.'

'Go on.'

'Look at the situation. Here is a completely empty, lifeless world - yet it is suitable for human beings. It has water, and an atmosphere we can breathe. It comes from the remote depths of space, aimed precisely at the solar system - something quite incredible, if it was a matter of pure chance. And it appears not only new; it looks as if it has never been used.'

We've all been through this dozens of times, Norton told himself. What could Boris add to it?

'Our faith has told us to expect such a visitation though we do not know exactly what form it will take. The Bible gives hints. If this is not the Second Coming, it may be the Second Judgement; the story of Noah describes the first. I believe that Rama is a cosmic Ark, sent here to save - those who are worthy of salvation.'

There was silence for quite a while in the Captain's cabin. It was not that Norton was at a loss for words; rather, he could think of too many questions, but he was not sure which ones it would be tactful to ask.

Finally he remarked, in as mild and non-committal a voice as he could manage: 'That's a very interesting concept, and though I don't go along with your faith, it's a tantalizingly plausible one.' He was not being hypocriti-

cal or flattering; stripped of its religious overtones, Rodrigo's theory was at beast as convincing as half a dozen others he had heard. Suppose some catastrophe was about to befall the human race, and a benevolent higher intelligence knew all about it? That would explain everything, very neatly. However, there were still a few problems...

'A couple of questions, Boris. Rama will be at perihelion in three weeks; then it will round the 'sun and leave the solar system just as fast as it came in. There's not much time for a Day of Judgement or for shipping across those who are, er, selected - however that's going to be done.'

'Very true. So when it reaches perihelion, Rama will have to decelerate and go into a parking orbit - probably one with aphelion at Earth's orbit. There it might make another velocity change, and rendezvous with Earth.'

This was disturbingly persuasive. If Rama wished to remain in, the solar system, it was going the right way about it. The most efficient way to slow down was to get as close to the sun as possible, and carry out the braking manoeuvre there. If there was any truth in Rodrigo's theory - or some variant of it - it would soon be put to the test.

'One other point, Boris. What's controlling Rama now?'

'There is no doctrine to advise on that. It could be a pure robot. Or it could be - a spirit. That would explain why there are no signs of biological life-forms.'

The Haunted Asteroid; why had that phrase popped up from the depths of memory? Then be recalled a silly story he had read years ago; he thought it best not to ask Boris if he had ever run into it. He doubted if the other's tastes ran to that sort of reading.

'I'll tell you what we'll do, Boris,' said Norton, abruptly making up his mind. He wanted to terminate this interview before it got too difficult, and thought he had found a good compromise.

'Can you sum up your ideas in less than - oh, a thousand bits?'

'Yes, I think so.'

'Well, if you can make it sound like a straightforward scientific theory, I'll send it, top priority, to the Rama Committee. Then a copy can go to your Church at the same time, and everyone will be happy.'

'Thank you, Commander, I really appreciate it.'

'Oh, I'm not doing this to save my conscience. I'd just bike to see what the Committee makes of it. Even if I don't agree with you all along the line, you may have hit on something important.'

'Well, we'll know at perihelion, won't we?'

'Yes. We'll know at perihelion.'

When Boris Rodrigo had left, Norton called the bridge and gave the necessary authorization. He thought he had solved the problem rather neatly; besides, just suppose that Boris was right.

He might have increased his chances of being among the saved.

CHAPTER TWENTY-ONE - After the Storm

As they drifted along the now familiar corridor of the Alpha Airlock complex, Norton wondered if they had let impatience overcome caution. They had waited aboard Endeavour for forty-eight hours - two precious days - ready for instant departure if events should justify it. But nothing had happened; the instruments left in Rama had detected no unusual activity. Frustratingly, the television camera on the Hub had been blinded by a fog which had reduced visibility to a few metres and bad only now started to retreat.

When they operated the final airlock door, and floated out into the cat's-cradle of guide-ropes around the Hub, Norton was struck first by the change in the light. It was no longer harshly blue, but was much more mellow and gentle, reminding him of a bright, hazy day on Earth.

He looked outwards along the axis of the world - and could see nothing except a glowing, featureless tunnel of white, reaching all the way to those strange mountains at the South Pole. The interior of Rama was completely blanketed with clouds, and nowhere was a break visible in the overcast. The top of the layer was quite sharply de' fined; it formed a smaller cylinder inside the larger one of this spinning world, leaving a central core, five or six kilometres wide, quite clear except for a few stray wisps of cirrus.

The immense tube of cloud was bit from underneath by the six artificial suns of Rama. The locations of the three on this Northern continent were dearly defined by diffuse strips of light, but those on the far side of the Cylindrical Sea merged together into a continuous, glow- ing band.

What is happening down beneath those clouds? Nor- ton asked himself. But at least the storm, which had

centrifuged them into such perfect symmetry about the axis of Rama, had now died away. Unless there were some other surprises, it would be safe to descend.

It seemed appropriate, \n this return visit, to use the team that had made the first deep penetration into Rama. Sergeant Myron - like every other member of Endeavour's crew - now fully met Surgeon-Commander Ernst's physical requirements; he even maintained, with convincing sincerity, that he was never going to wear his old uniforms again.

As Norton watched Mercer, Calvert and Myron 'swimming' quickly and confidently down the ladder, he reminded himself how much had changed. That first time they had descended in cold and darkness; now they were going towards light and warmth. And on all earlier visits, they had been confident that Rama was dead. That might yet be true, in a biological sense. But something was stirring; and Boris Rodrigo's phrase would do as well as any other. The spirit of Rama was awake.

When they had reached the platform at the foot of the ladder and were preparing to start down the stairway, Mercer carried out his usual routine test of the atmosphere. There were some things that he never took for granted; even when the people around him were breathing perfectly comfortably, without aids, he had been known to stop for an air check before opening his helmet. When asked to justify such excessive caution, he had answered: 'Because human senses aren't good enough, that's why. You may think you're fine, but you could fall flat on your face with the next deep breath.'

He booked at his meter, and said 'Damn!'

'What's the trouble?' asked Calvert.

'It's broken - reading too high. Odd; I've never known that to happen before. I'll check it on my breathing circuit.'

He plugged the compact little analyser into the test point of his oxygen supply, then stood in thoughtful silence for a while. His companions booked at him with anxious concern; anything that upset Karl was to be taken very seriously indeed.

He unplugged the meter, used it to sample the Rama atmosphere again, then called Hub Control.

'Skipper! Will you take an 02 reading?'

There was a much longer pause than the request justified. Then Norton radioed back: 'I think there's something wrong with my meter.'

A slow smile spread across Mercer's face.

'It's up fifty per cent, isn't it?'

'Yes, what does that mean?'

'It means that we can all take off our masks. Isn't that convenient?'

'I'm not sure,' replied Norton, echoing the sarcasm in Mercer's voice. 'It seems too good to be true.' There was no need to say any more. Like all spacemen, Commander Norton had a profound suspicion of things that were too good to be true.

Mercer cracked his mask open a trifle, and took a cautious sniff. For the first time at this altitude, the air was perfectly breathable. The musty, dead smell had gone; so had the excessive dryness, which in the past had caused several respiratory complaints. Humidity was now an astonishing eighty per cent; doubtless the thawing of the Sea was responsible for this. There was a muggy feeling in the air, though not an unpleasant one. It was like a summer evening, Mercer told himself, on some tropical coast. The climate inside Rama had improved dramatically during the last few days...

And why? The increased humidity was no problem; the startling rise in oxygen was much more difficult to explain.

As he recommenced the descent, Mercer began a whole series of mental calculations. He 'had not arrived at any satisfactory result by the time they entered the cloud layer.

It was a dramatic experience, for the transition was very abrupt. At one moment they were sliding downwards in clear air, gripping the smooth metal of the handrail so that they would not gain speed too swiftly in this quarter-of-a-gravity region. Then, suddenly, they shot into a blinding white fog, and visibility dropped to a few metres. Mercer put on the brakes so quickly that Calvert almost bumped into him - and Myron did bump into Calvert, nearly knocking him off the rail.

'Take it easy,' said Mercer. 'Spread out so we can just see each other. And don't let yourself build up speed, in case I have to stop suddenly.'

In eerie silence, they continued to glide, downwards through 'the fog. Calvert could just see Mercer as a vague shadow ten metres ahead, and 'when he looked back, 'Myron was at the same distance behind him. In some ways, this was even spookier than descending in the complete darkness of the Raman night; then, at least, the searchlight beams had shown them what lay ahead. But'

this was like diving in poor visibility in the open sea.

It was impossible to tell how far they had travelled, and Calvert guessed they had almost reached the fourth level when Mercer suddenly braked again. When they had bunched together, he whispered: 'Listen! Don't you hear something?'

'Yes,' said Myron, after a minute. 'It sounds bike the wind.'

Calvert was not so sure. He turned his head back and forth, trying to locate the direction of the very faint murmur that had come to them through the fog, then abandoned the attempt as hopeless.

They continued the slide, reached the fourth level, and started on towards the fifth. All the while the sound grew louder - and more hauntingly familiar. They were half-way down the fourth stairway before Myron called out: 'Now do you recognize it?'

They would have identified it bong ago, but it was not a sound they would ever have associated with any world except Earth. Coming out of the fog, from a source whose distance could not be guessed, was the steady thunder of falling water.

A few minutes later, the cloud ceiling ended as ab-ruptly as it had begun. They shot out into the blinding glare of the Raman day, made more brilliant by the bight reflected from the low-hanging clouds. There was the familiar curving plain - now made more acceptable to mind and senses, because its full circle could no longer be seen. It was not too difficult to pretend that they were booking along a broad valley, and that the upward sweep of the Sea was really an outward one.

They halted at the fifth and penultimate platform, to report that they were through the cloud cover and to make a careful survey. As far as they could tell, nothing had changed down there on the plain; but up here on the Northern dome, Rama had brought forth another won-der.

So there was the origin of the sound they had heard. Descending from some hidden source in 'the clouds three or four kilometres away was a waterfall, and for long minutes they stared at it silently, almost unable to be-lieve their eyes. Logic told them that on this spinning world no falling object could move in a straight line, but there was something horribly unnatural about a curving waterfall that curved sideways, to end many kilometres away from the point directly below its source...

'If Galileo had been born in this world,' said Mercer at length, 'he'd have gone crazy working out the laws of

dynamics.'

'I thought I knew them,' Calvert replied, 'and I'm going crazy anyway. Doesn't it upset you, Prof?'

'Why should it?' said Sergeant Myron. 'It's a perfectly straightforward demonstration of the Coriolis Effect. I wish I could show it to some of my students.'

Mercer was staring thoughtfully at the globe-circling band of the Cylindrical Sea.

'Have you noticed what's happened to the water?' he said at last.

'Why - it's no longer so blue. I'd call it pea-green. What does that signify?'

'Perhaps the same thing that it does on Earth. Laura called the Sea an organic soup waiting to be shaken into life. Maybe that's exactly what's happened.'

'In a couple of days! It took millions of years on Earth.'

'Three hundred and seventy-five million, according to the latest estimate. So that's where the oxygen's come from. Rama's shot through the anerobic stage and has got to photosynthetic plants - in about forty-eight hours. I wonder what it will produce tomorrow?'

CHAPTER TWENTY-TWO - To Sail the Cylindrical Sea

When they reached the foot of the stairway, they had another shock. At first, it appeared that something had gone through the camp, overturning equipment, even collecting smaller objects and carrying them away. But after a brief examination, their alarm was replaced by a rather shame-faced annoyance.

The culprit was only the wind; though they had tied down all loose objects before they left, some ropes must have parted during exceptionally strong gusts. It was several days before they were able to retrieve all their scattered property.

Otherwise, there seemed no major changes. Even the silence of Rama had returned, now that the ephemeral storms of spring were over. And out there at the edge of the plain was a calm sea, waiting for the first ship in a million years.
'Shouldn't one christen a new boat with a bottle of champagne?'

'Even if we had any on board, I wouldn't allow such a criminal waste. Anyway, it's too bate. We've already launched the thing.'

'At least it does float. You've won your bet, Jimmy. I'll settle when we get back to Earth.'

'It's got to have a name. Any ideas?'

The subject of these unflattering comments was now bobbing beside the steps beading down into the Cylindrical Sea. It was a small raft, constructed from six empty storage drums held together by a light metal framework. Building it, assembling it at Camp Alpha and hauling it on demountabbe wheels across more than ten kilometres of plain had absorbed the crew's entire energies for several days. It was a gamble that had better pay off.

The prize was worth the risk. The enigmatic towers of New York, gleaming there in the shadowless bight five kilometres away, had taunted them ever since they had entered Rama. No one doubted that the city - or whatever it might be - was the real heart of this world. If they did nothing else, they must reach New York.

'We still don't have a name. Skipper - what about it?'

Norton laughed, then became suddenly serious.

'I've got one for you. Call it Resolution.'

'Why?'

'That was one of Cook's ships. It's a good name - may she live up to it.'

There was a thoughtful silence; then Sergeant Barnes, who had been principally responsible for the design, asked for three volunteers. Everyone present held up a hand.

'Sorry - we only have four life-jackets. Boris, Jimmy, Pieter - you've all done some sailing. Let's try her out.'

No one thought it in the least peculiar that an Executive Sergeant was now taking charge of the proceedings. Ruby Barnes had the only Master's Certificate aboard, so that settled the matter. She had navigated racing trimarans across the Pacific, and it did not seem likely that a few kilometres of dead-calm water could present much of a challenge to her skills.

Ever since she had set eyes upon the Sea, she had been determined to make this voyage. In all the thousands of years that man had had dealings with the waters of his own world, no sailor had ever faced anything remotely like this. In the last few days a silly little jingle had been running through her mind, and she could not get rid of it. 'To sail the Cylindrical Sea...' Well, that was precisely what she was going to do.

Her passengers took their places on the improvised bucket seats, and Ruby opened the throttle. The twenty-kilowatt motor started to whirr, the chain-drives of the reduction gear blurred, and Resolution surged away to the cheers of the spectators.

Ruby had hoped to get fifteen kph with this load, but would settle for anything over ten. A half-kilometre course had been measured along the cliff, and she made the round trip in five and a half minutes. Allowing for turning time, this worked out at twelve kph; she was quite happy with that.

With no power, but with three energetic paddlers helping her own more skilful blade, Ruby was able to get a quarter of this speed. So even if the motor broke down, they could get back to shore in a couple of hours. The heavy-duty power cells could provide enough energy to circumnavigate the world; she was carrying two spares, to be on the safe side. And now that the fog had completely burned away, even such a cautious mariner as Ruby was prepared to put to sea without a compass.

She saluted smartly as she stepped ashore.

'Maiden voyage of Resolution successfully completed, Sir. Now awaiting your instructions.'

'Very good ... Admiral. When will you be ready to sail?'

'As soon as stores can be loaded aboard, and the Harbour Master gives us clearance.'

'Then we leave at dawn.'

'Aye, aye, Sir.'

Five kilometres of water does not seem very much on a map; it is very different when one is in the middle of it. They had been cruising for only ten minutes, and the fifty-metre cliff facing the Northern Continent already seemed a surprising distance away. Yet, mysteriously, New York hardly appeared much closer than before...

But most of the time they paid little attention to the land; they were still too engrossed in the wonder of the Sea. They no longer made the nervous jokes that had punctuated the start of the voyage; this new experience was too overwhelming.

Every time, Norton told himself, he felt that he had grown accustomed to Rama, it produced some new wonder. As Resolution hummed steadily forward, it seemed that they were caught in the trough of a gigantic wave - a wave which curved u~ on either side until it became

vertical - then overhung until the two flanks met in a liquid arch sixteen kilometres above their heads. Despite everything that reason and logic told them, none of the voyagers could for long throw off the impression that at any minute those millions of tons of water would come crashing down from the sky.

Yet despite this, their main feeling was one of exhilaration; there was a sense of danger, without any real danger. Unless, of course, the Sea itself produced any more surprises.

That was a distinct possibility, for as Mercer had guessed, the water was now alive. Every spoonful contained thousands of spherical, single-celled micro-organisms, similar to the earliest forms of plankton that had existed in the oceans of Earth.

Yet they showed puzzling differences; they lacked a nucleus, as well as many of the other minimum requirements of even the most primitive terrestrial life-forms. And although Laura Ernst - now doubling as research scientist as well as ship's doctor - had proved that they definitely generated oxygen, there were far too few of them to account for the augmentation of Rama's atmosphere. They should have existed in billions, not mere thousands.

Then she discovered that their numbers were dwindling rapidly, and must have been far higher during the first hours of the Raman dawn. It was as if there had been a brief explosion of life, recapitulating on a trillion-fold swifter time-scale the early history of Earth. Now, perhaps, it had exhausted itself; the drifting micro-organisms were disintegrating, releasing their stores of chemicals back into the Sea.

'If you have to swim for it,' Dr Ernst had warned the mariners, 'keep your mouths closed. A few drops won't matter - if you spit them out right away. But all those weird organo-metallic salts add up to a fairly poisonous package, and I'd hate to have to work out an antidote.'

This danger, fortunately, seemed very unlikely. Resolution could stay afloat if any two of her buoyancy tanks were punctured. (When told of this, Joe Calvert had muttered darkly: 'Remember the Titanic! ') And even if she sank, the crude but efficient life-jackets would keep their heads above, water. Although Laura had been reluctant to give a firm ruling on this, she did not think that a few hours' immersion in the Sea would be fatal; but she did not recommend it.

After twenty minutes of steady progress, New York was no longer a distant island. It was becoming a real place, and details which they had seen only through telescopes and photo-enlargements were now revealing themselves

as massive, solid structures. It was now strikingly apparent that the 'city', like so much of Rama, was triplicated; it consisted of three identical, circular complexes or superstructures, rising from a long, oval foundation. Photographs taken from the Hub also indicated that each complex was itself divided into three equal components, like a pie sliced into 120-degree portions. This would greatly simplify the task of exploration; presumably they had to examine only one ninth of New York to have seen the whole of it. Even this would be a formidable undertaking; it would mean investigating at least a square kilometre of buildings and machinery, some of which towered hundreds of metres into the air.

The Ramans, it seemed, had brought the art of triple-redundancy to a high degree of perfection. This was demonstrated in the airlock system, the stairways at the Hub, the artificial suns. And where it really mattered, they had even taken the next step. New York appeared to be an example of triple-triple redundancy.

Ruby was steering Resolution towards the central complex, where a flight of steps led up from the water to the very -top of the wall or levee which surrounded the island. There was even a conveniently-placed mooring post to which boats could be tied; when she saw this, Ruby became quite excited. Now she would never be content until she found one of the craft in which the Ramans sailed their extraordinary sea.

Norton was the first to step ashore; he looked back at his three companions and said: 'Wait here on the boat until I get to the top -of the wall. When I wave, Pieter and Boris will join me. You stay at the helm, Ruby, so that we can cast off at a moment's notice. If anything happens to me, report to Karl and follow his instructions. Use your best judgement - but no heroics. Understood?'
'Yes, Skipper. Good luck!'

Commander Norton did not really believe in luck; he never got into a situation until he had analysed all the factors involved and had secured his line of retreat. But once again Rama was forcing him to break some of his cherished rules. Almost every factor here- was unknown - as unknown as the Pacific and the Great Barrier Reef had been to his hero, three and a half centuries ago... Yes, he could do with all the luck that happened to be lying around.

The stairway was a virtual duplicate of the one down which they had descended on the other side of the Sea; doubtless his friends over there Were looking straight across at him through their telescopes. And 'straight' was now the correct word; in this one direction, parallel to the axis of Rama, the Sea was indeed completely flat. It might well be the only body of water in the universe of which this was true, for on all other worlds, every sea or

lake must follow the surface of a sphere, with equal curvature in all directions.

'Nearly at the top,' he reported, speaking for the record and for his intently listening second-in-command, five kilometres away, 'still completely quiet - radiation normal. I'm holding the meter above my head, just in case this wall is acting as a shield for anything. And if there are any hostiles on the other side, they'll shoot that first.'

He was joking, of course. And yet - why take any chances, when it was just as easy to avoid them?

When he - took the last step, he found that the flat-topped embankment was about ten metres thick; on the inner side, an alternating series of ramps and stairways led down to the main level of the city, twenty metres below. In effect, he was standing on a high wall which completely surrounded New York, and so was able to get a grandstand view of it.

It was a view almost stunning in its complexity, and his first act was to make a slow panoramic scan with his camera. Then he waved to his companions and radioed back across the Sea: 'No sign of any activity - everything quiet. Come on up - we'll start exploring.'

CHAPTER TWENTY-THREE - NY, Rama

It was not a city; it was a machine. Norton had come to that conclusion in ten minutes, and saw no reason to change it after they had made a complete traverse of the island. A city - whatever - the nature of its occupants - surely had to provide some form of accommodation: there was nothing here of that - nature, unless it was underground. And if that was the case, where were the entrances, the stairways, the elevators? He had not found anything that even qualified as a simple door...

The closest analogy he had ever seen to this place on Earth was a giant chemical processing plant. However, there were no stockpiles of raw materials, or any indications of a transport system to move them around. Nor could he imagine where the finished product would emerge - still less what that product could possibly be. It was all very baffling, and more than a little frustrating.

'Anybody care to make a guess?' he said at last, to all who might be listening. 'If this is a factory, what does it make? And where does it get its raw materials?'

'I've a suggestion, Skipper,' said Karl Mercer, over on the far shore. 'Suppose it uses the Sea. According to Doc, that contains just about anything you can think of.'

It was a plausible answer, and Norton had already considered it. There could well be buried pipes leading to

the Sea - in fact, there must be, for any conceivable chemical plant would require large quantities of water. But he had a suspicion of plausible answers; they were so often wrong.

'That's a good idea, Karl; but what does New York do with its seawater?'

For a long time, nobody answered from ship, Hub or Northern plain. Then an unexpected voice spoke.

'That's easy, Skipper. But you're all going to laugh at me.'

'No, we're not, Ravi. Go ahead.'

Sergeant Ravi McAndrews, Chief Steward and Simp Master, was the last person on this ship who would normally get involved in a technical discussion. His IQ was modest and his scientific knowledge was minimal, but he was no fool and had a natural shrewdness which everyone respected.

'Well, it's a factory all right, Skipper, and maybe the Sea - provides the raw material ... after all, that's how it all happened on Earth, though in a different way ... I believe New York is a factory for making - Ramans.

Somebody, somewhere, snickered, but became quickly silent and did not identify himself.

'You know, Ravi,' said his commander at last, 'that theory is crazy enough to be true. And I'm not sure if I want to see it tested ... at least, until I get back to the mainland.'

This celestial New York was just about as wide as the island of Manhattan, but its geometry was totally different. There were few straight thoroughfares; it was a maze of short, concentric arcs, with radial spokes linking them. Luckily, it was impossible to lose one's bearings inside Rama; a single glance at the sky was enough to establish the north-south axis of the world.

They paused at almost every intersection to make a panoramic scan. When all these hundreds of pictures were sorted out, it would be a tedious but fairly straightforward job to construct an accurate scale model of the city. Norton suspected that the resulting jigsaw puzzle would keep scientists busy for generations.

It was even harder to get used to the silence here than it had been out on the plain of Rama. A city-machine should make some sound; yet there - was not even the faintest of electric hums, or the slightest whisper of mechanical motion. Several times Norton put his ear to the ground, or to the side of a building, and listened in-

tently. He could hear nothing except the pounding of his own blood,

The machines were sleeping: they were not even ticking over. Would they ever wake again, and for what purpose? Everything was in perfect condition, as usual. It was easy to believe that the closing of a single circuit, in some patient, hidden computer, would bring all this maze back to life.

When at last they had reached the far side of the city, they climbed to the top of the surrounding levee and looked across the southern branch of the Sea. For a long time Norton stared at the five-hundred-metre cliff that barred them from almost half of Rama - and, judging from their telescopic surveys, the most complex and varied half. From this angle, it appeared an ominous, forbidding black, and it was easy to think of it as a prison wall surrounding a whole continent. Nowhere along its entire circle was there a flight of stairways or any other means of access.

He wondered how the Ramans reached their southern land from New York. Probably there was an underground transport system running beneath the Sea, but they must also have aircraft as well; there were many open areas here in the city that could be used for landing. To discover a Raman vehicle would be a major accomplishment - especially if -they could learn to operate it. (Though could any conceivable power-source still be functioning, after several hundred thousand years?)

There were numerous structures that had the functional look of hangars or garages, but they were all smooth and windowless, as if they had been sprayed with sealant. Sooner or later, Norton had told himself grimly, we'll be forced to use explosives, and laser beams. He was determined to put off this decision to the last possible moment.

His reluctance to use brute force was based partly on pride, partly on fear. He did not wish to behave like a technological barbarian, smashing what he could not understand. After all, he was an uninvited visitor in this world, and should act accordingly.

As for his fear - perhaps that was too strong ~ word; apprehension might be better. The Ramans seemed to have planned for everything; he was not anxious to discover the precautions they had taken to guard their property. When he sailed back to the mainland, it would be with empty hands.

CHAPTER TWENTY-FOUR - Dragonfly

Lieutenant James Pak was the most junior officer on board Endeavour, and this was only his fourth mission into deep space. He was ambitious, and due for promo-

tion; he had also committed a serious breach of regulations. No wonder, therefore, that he took a long time to make up his mind.

It would be a gamble; if he lost, he could be in deep trouble. He could not only be risking his career; he might even be risking his neck. But if he succeeded, he would be a hero. What finally convinced him was neither of these arguments; it was the certainty that, if he did nothing at all, he would spend the rest of his life brooding over his lost opportunity. Nevertheless, he was still hesitant when he asked the Captain for a private meeting.

What is it this time? Norton asked himself, as he analysed the uncertain expression on the young officer's face. He remembered his delicate interview with Boris Rodrigo; no, it wouldn't be anything like that. Jimmy was certainly not the religious type; the only interests he had ever shown outside his work were sport and sex, preferably combined. -

It could hardly be the former, and Norton hoped it was not the latter. He had encountered most of the problems that a commanding officer could encounter in this department - except the classical one o-f an unscheduled birth during a mission. Though this situation was the subject of innumerable jokes, it had never happened yet; of time.

'Well, Jimmy, what is it?'

'I have an idea, Commander. I know how to reach the southern continent - even to the South Pole.'

'I'm listening. How do you propose to do it?'

'Er - by flying there.'

'Jimmy, I've had at least five proposals to do that - more if you count crazy suggestions from Earth. We've looked into the possibility of adapting our spacesuit propulsors, but air drag would make them hopelessly inefficient. They'd run out of fuel before they could go ten kilometres.'

'I know that. But I have the answer.'

Lt Pak's attitude was a curious mixture of complete confidence and barely suppressed nervousness. Norton was quite baffled; what was the kid worried about? Surely he knew his commanding officer well enough to be certain that no reasonable proposal would be laughed out of court.

'Well, go on. If it works, I'll see your promotion is retroactive.'

That little half-promise, half-joke didn't go down as well as he had hoped. Jimmy gave a rather sickly smile, made several false starts, then decided on an oblique approach to the subject.

'You know, Commander, that I was in the Lunar Olympics last year.'

'Of course. Sorry you didn't win.'

'It was bad equipment; I know what went wrong. I have friends on Mars who've been working on it, in secret. We want to give everyone a surprise.'

'Mars? But I didn't know...'

'Not many people do - the sport's still new there; it's only been tried in the Xante Sportsdome. But the best aerodynamicists in the solar system are on Mars; if you can fly in that atmosphere, you can fly anywhere.

'Now, my idea was that if the Martians could build a good machine, with all their know-how, it would really perform on the Moon - where gravity is only half as strong.'

'That seems plausible, but how does it help us?'

Norton was beginning to guess, but he wanted to give Jimmy plenty of rope.

'Well, I formed a syndicate with some friends in Lowell City. They've built a fully aerobatic flyer with some refinements that no one has ever seen before. In lunar gravity, under the Olympic dome, it should create a sensation.'

'And win you the gold medal.'

'I hope so.'

'Let me see if I follow your train of thought correctly. A sky-bike that could enter the Lunar Olympics, at a sixth of a gravity, would be even more sensational inside Rama, with no gravity at all. You could fly it right along the axis, from the North Pole to the South - and back again.'

'Yes - easily. The one-way trip would take three hours, non-stop. But of course you could rest whenever you wanted to, as long as you kept near the axis.'
'It's -a brilliant idea, and I congratulate you. What a pity sky-bikes aren't part of regular Space Survey equipment.'

Jimmy seemed to have some difficulty in finding words.

He opened his mouth several times, but nothing happened.

'All right, Jimmy. As a matter of morbid interest, and purely off the record, how did you smuggle the thing aboard?'

'Er - "Recreational Stores".'

'Well, you weren't lying. And what about the weight?'

'It's only twenty kilograms.'

'Only! Still, that's not as bad as I thought. In fact, I'm astonished you can build a bike for that weight.'

'Some have been only fifteen, but they were too fragile and usually folded up when they made a turn. There's no danger of Dragonfly doing that. As I said, she's fully aerobatic.'

'Dragonfly - nice name. So tell me just how you plan to use her; then I can decide whether a promotion or a court martial is in order. Or both.'

CHAPTER TWENTY-FIVE - Maiden Flight

Dragonfly was certainly a good name. The long, tapering wings were almost invisible, except when the light struck them from certain angles and was refracted into rainbow hues. It was as if a soap-bubble had been wrapped round a delicate tracery of aerofoil sections; the envelope endosing the little flyer was an organic film only a few molecules thick, yet strong enough to control and direct the movements of a fifty-kph air flow.

The pilot - who was also the powerplant and the guidance system - sat on a tiny seat at the centre of gravity, in a semi-reclining position to reduce air resistance. Control was by a single stick which could be moved backwards and forwards, right and left; the only 'instrument' was a piece of weighted ribbon attached to the leading edge, to show the direction of the relative wind.

Once the flyer had been assembled at the Hub, Jimmy Pak would allow no one to -touch it. Clumsy handling could snap one of the single-fibre structural members, and those glittering wings were an almost irresistible attraction to prying fingers. It was hard to believe that there was really something there...

As he watched Jimmy climb into the contraption, Commander Norton began to have second thoughts. If one of those wire-sized struts snapped when Dragonfly was on the other side of the Cylindrical Sea, Jimmy would have no way of getting back - even if he was able to make a safe landing. They were also breaking one of the most

sacrosanct rules of space exploration; a man was going alone into unknown territory, beyond all possibility of help. The only consolation was that he would be in full view and communication all the time; they would know exactly what had happened to him, if he did meet with disaster.

Yet this opportunity was far too good to miss; if one believed in fate or destiny, it would be challenging the gods themselves to neglect the only chance they might ever have of reaching the far side of Rama, and seeing at close quarters the mysteries of the South Pole. Jimmy knew what he was attempting, far better than anyone in the crew could tell him. This was precisely the sort of risk that had to be taken; if it failed, that was the luck of the game. You couldn't win them all...

'Now listen to me carefully, Jimmy,' said Surgeon-Commander Ernst. 'It's very important not to over-exert yourself. Remember, the oxygen level here at the axis is still very low. If you feel breathless at any time, stop and hyperventilate for thirty seconds - but no longer.'

Jimmy nodded absentmindedly as he tested the controls. The whole rudder-elevator assembly, which formed a single unit on an outrigger five metres behind the rudimentary cockpit, began to twist around; then the flap-shaped ailerons, halfway along the wing, moved alternately up and down.

'Do you want me to swing the prop?' asked Joe Calvert, unable to suppress memories of two-hundred-year-old war movies. 'Ignition! Contact!' Probably no one except Jimmy knew what he was talking about, but it helped to relieve the tension.

Very slowly, Jimmy started to move the foot-pedals. The flimsy, broad fan of the airscrew - like the wing, a delicate skeleton covered with shimmering film - began to turn. By the time it had made a few revolutions, it had disappeared completely; and Dragonfly was on her way.

She moved straight outwards from the Hub, moving slowly along the axis of Rama. When she had travelled a hundred metres, Jimmy stopped pedalling; it was strange to see an obviously aerodynamic vehicle hanging motionless in mid-air. This must be the first time such a thing had ever happened, except possibly on a very limited scale inside one of the larger space-stations.

'How does she handle?' Norton called.

'Response good, stability poor. But I know what the trouble is - no gravity. We'll be better off a kilometre lower down.'

'Now wait a minute- is that safe?'

By losing altitude, Jimmy would be sacrificing his main advantage. As long as he stayed precisely on the axis, he - and Dragonfly - would be completely weightless. He could hover effortlessly, or even go to sleep if he wished. But as soon as he moved away from the central line around which Rama spun, the pseudo-weight of centrifugal force would reappear.

And so, unless he could maintain himself at this altitude, he would continue to lose height - - and at the same time, to gain weight. It would be an accelerating process, which could end in catastrophe. The gravity down on the plain of Rama was twice that in which Dragonfly had been designed to operate. Jimmy might be able to make a safe landing; he could certainly never take off again.

But he had already considered all this, and he answered confidently enough: 'I can manage a tenth of a gee without any trouble. And she'll handle more easily in denser air.

In a slow, leisurely spiral, Dragonfly drifted across the sky, roughly following the line of Stairway Alpha down towards the plain. From some angles, the little sky-bike was almost invisible; Jimmy seemed to be sitting in mid-air pedalling furiously. Sometimes he moved into spurts of up to thirty kilometres an hour; then he would coast to a halt, getting the feel of the controls, before accelerating again. And he was always very careful to keep a safe distance from the curving end of Rama.

It was soon obvious that Dragonfly handled much better at lower altitudes; she no longer rolled around at any angle, - but stabilized so that her wings were parallel to the plain seven kilometres below. Jimmy completed several wide orbits, then started to climb upwards again. He finally halted a Jew metres above his waiting colleagues and realized, a little belatedly, that he was not quite sure how to land this gossamer craft.

'Shall we throw you a rope?' Norton asked half-seriously.

'No, Skipper - I've got to work this out myself. I won't have anyone to help me at the other end.'

He sat thinking for a while, then started to ease Dragonfly towards the Hub with short bursts of power. She quickly lost momentum between each, as air drag brought her to rest again. When he was only five metres away, and the sky-bike was still barely moving, Jimmy abandoned ship. He let himself float towards the nearest safety line in the Hub webwork, grasped it, then swung around in time to catch the approaching bike with his hands. The manoeuvre was so neatly executed that it drew a round of applause.

'For my next act-' Joe Calvert began.

Jimmy was quick to disclaim any credit.

'That was messy,' he said. 'But now I know how to do it. I'll take a sticky-bomb on a twenty-metre line; then I'll be able to pull myself in wherever I want to.' --

'Give me your wrist, Jimmy,' ordered the Doctor, 'and blow into this bag. I'll want a blood sample, too. Did you have any difficulty in breathing?'

'Only at this altitude. Hey, what do you want the blood for?'

'Sugar level; then I can tell how much energy you've used. We've got to make sure you carry enough fuel for the mission. By the way, what's the endurance record for sky-biking?'

'Two hours twenty-five minutes three point six seconds. On the Moon, of course - a two kilometre circuit in the Olympic Dome.'

'And you think you can keep it up for six hours?'

'Easily, since I can stop for a rest at any time. Sky-biking on the Moon is at least twice as hard as it is here.'

'OK Jimmy - back to the lab. I'll give you a Go-No-Go as soon as I've analysed these samples. I don't want to raise false hopes - but I think you can make it.'

A large smile of satisfaction spread across Jimmy Pak's ivory-hued countenance. As he followed Surgeon-Commander Ernst to the airlock, he called back to his companions: 'Hands off, please! I don't Want anyone putting his fist through the wings.'

'I'll see to that, Jimmy,' promised the Commander. 'Dragonfly is off limits to everybody - including myself.'

CHAPTER TWENTY-SIX - The Voice of Rama

The real magnitude of his adventure did not hit Jimmy Pak until he reached the coast of the Cylindrical Sea. Until now, he had been over known territory; barring a catastrophic structural failure, he could always land and walk back to base in a few hours.

That -option no longer existed. If he came down in the Sea, he would probably drown, quite unpleasantly, in its poisonous waters. And even if he made a safe landing in the southern continent, it might be impossible to rescue him before Endeavour had to break away from Rama's sunward orbit.

He was also acutely aware that the foreseeable disasters were the ones most unlikely to happen. The totally unknown region over which he was flying might produce any number of surprises; suppose there were flying creatures here, who objected to his intrusion? He would hate to engage in a dog-fight with anything larger than a pigeon. A few well-placed pecks could destroy Dragonfly's aerodynamics.

Yet, if there were no hazards, there would be no achievement - no sense of adventure. Millions of men would gladly have traded places with him now. He was going not only where no one had ever been before - but where no one would ever go again. In all of history, he would be the only human being to visit the southern regions of Rama. Whenever he felt fear brushing against his mind, he could remember that.

He had now grown accustomed to sitting in mid-air, with the world wrapped around him. Because he had dropped two kilometres below the central axis, he had acquired a definite sense of 'up' and 'down'. The ground was only six kilometres below, but the arch of the sky was ten kilometres overhead. The 'city' of London was hanging up there near the zenith; New York, on the other hand, was the right way up, directly ahead.

'Dragonfly,' said Hub Control, 'you're getting a little low. Twenty-two hundred metres from the axis.'

'Thanks,' he replied. 'I'll gain altitude. Let me know when I'm back at twenty.'

This was something he'd have to watch. There was a natural tendency to lose height - and he had no instruments to tell him exactly where he was. If he got too far away from the zero-gravity of the axis, he might never be able to climb back to it. Fortunately, there was a wide margin for error, and there was always someone watching his progress through a telescope at the Hub.

He was now well out over the Sea, pedalling along at a steady twenty kilometres an hour. In five minutes, he would be over New York; already the island looked rather like a ship, sailing for ever round and round the Cylindrical Sea.

When he reached New York, he flew a circle over it, stopping several times so that his little TV camera could send back steady, vibration-free images. The panorama of buildings, towers, industrial plants, power stations - or whatever they were - was fascinating but essentially meaningless. No matter how long he stared at its complexity, he was unlikely to learn anything. The camera would record far more details than he could possibly assimilate; and one day - perhaps years hence - some stu-

dent might find in them the key to Rama's secrets.

After leaving New York, he crossed the other half of the Sea in only fifteen minutes. Though he was not aware of it, he had been flying fast over water, but as soon as he reached the south coast he unconsciously relaxed and his speed dropped by several kilometres an hour. He might be in wholly alien territory - but at least he was over land.

As soon as he had crossed the great cliff that formed the Sea's southern limit, he panned the TV camera completely round the circle of the world.

'Beautiful!' said Hub Control. 'This will keep the map-makers happy. How are you feeling?'

'I'm fine - just a little fatigue, but no more than I expected. How far do you make me from the Pole?'

'Fifteen point six kilometres.'

'Tell me when I'm at ten; I'll take a rest then. And make sure I don't get low again. I'll start climbing when I've five to go.'

Twenty minutes later the world was closing in upon him; he had come to the end of the cylindrical section, and was entering the southern dome.

He had studied it for hours through the telescopes at the other end of Rama, and had learned its geography by heart. Even so, that had not fully prepared him for the spectacle all around him.

In almost every way the southern and northern ends of Rama differed completely. Here was no triad of stairways, no series of narrow, concentric plateaux, no sweeping curve from hub to plain. Instead, there was an immense central spike, more than five kilometres long, extending along the axis. Six smaller ones, half this size, were equally spaced around it; the whole assembly looked like a group of remarkably symmetrical stalactites, hanging from the roof of a cave. Or, inverting the point of view, the spires of some Cambodian temple, set at the bottom of a crater...

Linking these slender, tapering towers, and curving down from them to merge eventually in the cylindrical plain, were flying buttresses that looked massive enough to bear the weight of a world. And this, - perhaps, was their function, if they were indeed the elements of some exotic drive units, as some had suggested.

Lieutenant Pak approached the central spike cautiously, stopped pedalling while he was still a hundred metres away, and let Dragonfly drift to rest. He checked the

radiation level, and found only Rama's very low background. There might be forces at work here which no human instruments could detect, but that was another unavoidable risk.

'What can you see?' Hub Control asked anxiously.

'Just Big Horn - it's absolutely smooth - no markings - and the point's so sharp you could use it as a needle. I'm almost scared to go near it.'

He was only half joking. It seemed incredible that so massive an object should taper to such a geometrically perfect point. Jimmy had seen collections of insects impaled upon pins, and he had no desire for his own Dragonfly to meet a similar fate.

He pedalled slowly forward until the spike had flared out to several metres in diameter, then stopped again. Opening a small container, he rather gingerly extracted a sphere about as big as a baseball, and tossed it towards the spike. As it drifted away, it played out a barely visible thread.

The sticky-bomb hit the smoothly curving surface - and did not rebound. Jimmy gave the thread an experimental twitch, then a harder tug. Like a fisherman hauling in his catch, he slowly wound Dragonfly across to the tip of the appropriately christened 'Big Horn', until he was able to put out his hand and make contact with it.

'I suppose you could call this some kind of touchdown,' he reported to Hub Control. 'It feels like glass - almost frictionless, and slightly warm. The sticky-bomb worked fine. Now I'm trying the mike ... let's see if the suction pad holds as well ... plugging in the leads ... anything coming through?'

There was a long pause from the Hub; then Control said disgustedly: 'Not a damn thing, except the usual thermal noises. Will you tap it with a piece of metal? Then at least we'll find if it's hollow.'

'OK. Now what?'

'We'd like you to fly along the spike, making a complete scan every half-kilometre, and looking out for anything unusual. Then, if you're sure it's safe, you might go across to one of the Little Horns. But only if you're certain you can get back to zero gee without any problems.'

'Three kilometres from the axis - that's slightly above lunar gravity. Dragonfly was designed for that. I'll just have to work harder.'

'Jimmy, this is the Captain. I've got second thoughts on that. Judging by your pictures, the smaller spikes are just

the same as the big one. Get the best coverage of them you can with the zoom lens. I don't want you leaving the low-gravity region ... unless you see something that looks very important. Then we'll talk it over.

'OK, Skipper,' said Jimmy, and perhaps there was just a trace of relief in his voice. 'I'll stay close to Big Horn. Here we go again.'

He felt he was dropping straight downwards into a narrow valley between a group of incredibly tall and slender mountains. -Big Horn now towered a kilometre above him, and the six spikes of the Little Horns were looming up all around. The complex of buttresses and flying arches which surrounded the lower slopes was approaching rapidly; he wondered if he could make a safe landing somewhere down there in that Cyclopean architecture. He could no longer land on Big Horn itself, for the gravity on its widening slopes was now too powerful to be counteracted by the feeble force of the sticky-bomb.

As he came even closer to the South Pole, he began to feel more and more like a sparrow flying beneath the vaulted roof of some great cathedral - though no cathedial ever built had been even one hundredth the size of this place. He wondered if it was indeed a religious shrine, or something remotely analogous, but quickly dismissed the idea. Nowhere in Rama had there been any trace of artistic expression; everything was purely functional. Perhaps the Ramans felt that they already knew the ultimate secrets of the universe, and were no longer - haunted by the yearnings and aspirations that drove mankind.

That was a chilling thought, quite alien to Jimmy's usual not-very-profound philosophy; he felt an urgent need to resume contact, and reported his situation back to his distant friends.

'Say again, Dragonfly,' replied Hub Control. 'We can't understand you - your transmission is garbled.'

'I repeat - I'm near the base of Little Horn number Six, and am using the sticky-bomb to haul myself in.'

'Understand only partially. Can you hear me?'

'Yes, perfectly. Repeat, perfectly.'

Please start counting numbers.'

'One, two, three, four...'

'Got part of that. Give us beacon for fifteen seconds, then go back to voice.'

'Here it is.'

Jimmy switched on the low-powered beacon which would locate him anywhere inside Rama, and counted off the seconds. When he went over to voice again he asked plaintively: 'What's happening? Can you hear me now?'

Presumably Hub didn't, because the controller then asked for fifteen seconds of TV. Not until Jimmy had repeated the question twice did the message get through.

'Glad you can hear us OK, Jimmy. But there's something very peculiar happening at your end. Listen.'

Over the radio, he heard the familiar whistle of his own beacon, played back to him. For a moment it was perfectly normal; then a weird distortion crept into it. The thousand-cycle whistle became modulated by a deep, throbbing pulse so low that it was almost beneath the threshold of hearing; it was a kind of basso-profundo flutter in which each individual vibration could be heard. And the modulation was itself modulated; it rose and fell, rose and fell with a period of about five seconds.

Never for a moment did it occur to Jimmy that there was something wrong with his radio transmitter. This was from outside; though what it was, and what it meant, was beyond his imagination.

Hub Control was not much wiser, but at least it had a theory.

'We think you must be in some kind of very intense field - probably magnetic - with a frequency of about ten cycles. It may be strong enough to be dangerous. Suggest you get Out right away - it may only be local. Switch on your beacon again, and we'll play it back to you. Then you can tell when you're getting clear of the interference.

Jimmy hastily jerked the sticky-bomb loose and abandoned his attempt to land. He swung Dragonfly round in a wide circle, listening as he did so to the sound that wavered in his earphones. After flying only a few metres, he could tell that its intensity was falling rapidly; as Hub Control had guessed, it was extremely localized.

He paused for a moment at the last spot where he could hear it, like a faint throbbing deep in his brain. So might a primitive savage have listened in awestruck ignorance to the low humming of a giant power transformer. And even the savage might have guessed that the sound he heard was merely the stray leakage from colossal energies, fully controlled, but biding their time...

Whatever this sound meant, Jimmy was glad to be clear of it. This was no place, among the overwhelming architecture of the South Pole, for a lone man to listen to

the voice of Rama.

CHAPTER TWENTY-SEVEN - Electric Wind

As Jimmy turned homewards, the northern end of Rama seemed incredibly far away. Even the three giant stairways were barely visible, as a faint Y etched on the dome that closed the world. The band of the Cylindrical Sea was a wide and menacing barrier, waiting to swallow him up if, like Icarus, his fragile wings should fail.

But he had come all this way with no problems, and though he was feeling slightly tired he now felt that he had nothing to worry about. He had not even touched his food or water, and had been too excited to rest. On the return journey, he would relax and take it easy. He was also cheered by the thought that the homeward trip could be twenty kilometres shorter than the outward one, for as long as he cleared the Sea, he could make an emergency landing anywhere in the northern continent. That would be a nuisance, because he would have a long walk - and much worse, would have to abandon Dragonfly - but it gave him a very comforting safety margin.

He was now gaining altitude, climbing back towards the central spike; Big Horn's tapering needle still stretched for a kilometre ahead of him, and sometimes he felt it was the axis on Which this whole world turned.

He had almost reached the tip of Big Horn when he became aware of a curious sensation; a feeling of foreboding, and indeed of physical as well as psychological discomfort, had come over him. He suddenly recalled - and this did nothing at all to help - a phrase he had once come across: 'Someone is walking over your grave.'

At first he shrugged it off, and continued his steady pedalling. He certainly had no intention of reporting anything as tenuous as a vague malaise to Hub Control, but as it grew steadily worse he was tempted to do so. It could not possibly be psychological; if it was, his mind was much more powerful than he realized. Forte could, quite literally, feel his skin beginning to crawl

Now seriously alarmed, he stopped in mid-air and began to consider the situation. What made it all the more peculiar was the fact that this depressed heavy feeling was not completely novel; he had known it before, but could not remember where.

He looked around him. Nothing had changed. The great spike of Big Horn was a few hundred metres above, with the other side of Rama spanning the sky beyond that. Eight kilometres below lay the complicated patchwork of the Southern continent, full of wonders that no other man would ever see. In all the utterly alien yet now familiar landscape, he could find no cause for his discom-

fort.

Something was tickling the back of his hand; for a moment, he thought an insect had landed there, and brushed it away without looking. He had only half-completed the swift motion when he realized what he was doing and checked himself, feeling slightly foolish. Of course, no one had ever seen an insect in Rama...

He lifted his hand, and stared at it, mildly puzzled because the tickling sensation was still there. It was then that he noticed that every individual hair was standing straight upright. All the way up his forearm it was the same - and so it was with his head, when he checked with an exploring hand.

So that was the trouble. He was in a tremendously powerful electric field; the oppressed, heavy sensation he had felt was that which sometimes precedes a thunderstorm on Earth.

The sudden realization of his predicament brought Jimmy very near to panic. Never before in his life had he been in real physical danger. Like all spacemen, he had known moments of frustration with bulky equipment, and times when, owing to mistakes or inexperience, he had wrongly believed he was in a perilous situation. But none of these episodes had lasted more than a few minutes, and usually he was able to laugh at them almost at once.

This time there was no quick way out. He felt naked and alone in a suddenly hostile sky, surrounded by titanic forces which might discharge their furies at any moment. Dragonfly - already fragile enough - now seemed more insubstantial than the finest gossamer. The first detonation of the gathering storm would blast her to fragments.

'Hub Control,' he said urgently. 'There's a static charge building up around me. I think there's going to be a thunderstorm at any moment.'

He had barely finished speaking when there was a flicker of light behind him; by the time he had counted ten, the first crackling rumble arrived. Three kilometres - that put it back around the Little Horns. He looked towards them and saw that every one of the six needles seemed to be on fire. Brush discharges, hundreds of metres long, were dancing from their points, as if they were giant lightning conductors.

What was happening back there could take place on an even larger scale near the tapering spike of Big Horn. His best move would be to get as far as possible from this dangerous structure, and to seek clear air. He started to pedal again, accelerating as swiftly as he could with-

out putting too great a strain on Dragonfly. At the same time he began to lose altitude; even though this would mean entering the region of higher gravity, he was now prepared to take such a risk. Eight kilometres was much too far from the ground for his peace of mind.

The ominous black spike of Big Horn was still free of visible discharges, but he did not doubt that tremendous potentials were building up there. From time to time the thunder still reverberated behind him, rolling round and round the circumference of the world. It suddenly occurred to Jimmy how strange it was to have such a storm In a perfectly clear sky; then he realized that this was not a meteorological phenomenon at all. In fact, it might be only a trivial leakage of energy from some hidden source, deep in the southern cap of Rama. But why now? And, even more important - what next?

He was now well past the tip of Big Horn, and hoped that he would soon be beyond the range of any lightning discharges. But now he had another problem; the air was becoming turbulent, and he had difficulty in controlling Dragonfly. A wind seemed to have sprung up from nowhere, and if conditions became much worse the bike's fragile skeleton would be endangered. He pedalled grimly on, trying to smooth out the buffeting by variations in power and movements of his body. Because Dragonfly was almost an extension of himself, he was partly successful; but he did not like the faint creaks of protest that came from the main spar, nor the way in which the wings twisted with every gust.

And there was something else that worried him - a faint rushing sound, steadily growing in strength, that seemed to come from the direction of Big Horn. It sounded like gas escaping from a valve under pressure, and he wondered if it had anything to do with the turbulence which he was battling. Whatever its cause, it gave him yet further grounds for disquiet.

From time to time he reported these phenomena, rather briefly and breathlessly, to Hub Control. No one there could give him any advice, or even suggest what might be happening; but it was reassuring to hear the voices of his friends, even though he was now beginning to fear that he would never see them again.

The turbulence was still increasing. It almost felt as if he was entering a jet stream - which he had once done, in search of a record, while flying a high-altitude glider on Earth. But what could possibly create a jet stream inside Rama?

He had asked himself the right question; as soon as he had formulated it, he knew the answer.

The sound he had heard was the electric wind carrying

away the tremendous ionization that must be building up around Big Horn. Charged air was spraying out along the axis of Rama, and more air was flowing into the low-pressure region behind. He looked back at that gigantic and now doubly threatening needle, trying to visualize the boundaries of the gale that was blowing from it. Perhaps the best tactic would be to fly by ear, getting as far as possible away from the ominous hissing.

Rama spared him the necessity of choice. A sheet of flame burst out behind him, filling the sky. He had time to see it split into six ribbons of fire, stretching from the tip of Big Horn to each of the Little Horns. Then the concussion reached him.

CHAPTER TWENTY-EIGHT - Icarus

Jimmy Pak had barely time to radio: 'The wing's buckling - I'm going to crash - I'm going to crash!' when Dragonfly started to fold up gracefully around him. The left wing snapped cleanly in the middle, and the outer section drifted away like a gently falling leaf. The right wing put up a more complicated performance. It twisted round at the root, and angled back so sharply that its tip became entangled in the tail. Jimmy felt that he was sitting in a broken kite, slowly falling down the sky.

Yet he was not quite helpless; the airscrew still worked, and while he had power there was still some measure of control. He had perhaps five minutes in which to use it.

Was there any hope of reaching the Sea? No - it was much too far away. Then he remembered that he was still thinking in terrestrial terms; though he was a good swimmer, it would be hours before he could possibly be rescued, and in that time the poisonous waters would undoubtedly have killed him. His only hope was to come down on land; the problem of the sheer southern cliff he would think about later - if there was any 'later'.

He was falling very slowly, here in this tenth-of-a-gravity zone, but would soon start to accelerate as he got further away from the axis. However, air-drag would complicate the situation, and would prevent him from building up too swift a rate of descent. Dragonfly, even without power, would act as a crude parachute. The few kilogrammes of thrust he could still provide might make all the difference between life and death; that was his only hope.

Hub had stopped talking; his friends could see exactly what was happening to him and knew that there was no way their words could help. Jimmy was now doing the most skilful flying of, his life; it was too bad, he thought with grim humour, that his audience was so small, and could not appreciate the finer details of his performance.

He was going down in a wide spiral, and as long as its

pitch remained fairly flat his chances of survival were good. His pedalling was helping to keep Dragonfly airborne, though he was afraid to exert maximum power in case the broken wings came completely adrift And every time he swung southwards, he could appreciate the fantastic display that Rama had kindly arranged for his benefit.

The streamers of lightning still played from the tip of Big Horn down to the lesser peaks beneath, but now the whole pattern was rotating. The six-pronged crown of fire was turning against the spin of Rama, making one revolution every few seconds. Jimmy felt that he was watching a giant electric motor in operation. and perhaps that was not hopelessly far from the truth.

He was halfway down to the plain, still orbiting in a fiat spiral, when the firework display suddenly ceased. He could feel the tension drain from the sky and knew, without looking, that the hairs on his arms were no longer straining upright. There was nothing to distract or hinder him now, during the last few minutes of his fight for life.

Now that he could be certain of the general area in which he must land, he started to study it intently. Much of this region was a checkerboard of totally conflicting environments, as if a mad landscape gardener had been given a free hand and told to exercise his imagination to the utmost. The squares of the checkerboard were almost a kilometre on a side, and though most of them were flat he could not be sure if they were solid, their colours and textures varied so greatly. He decided to wait until the last possible minute before making a decision - it indeed he had any choice.

When there were a few hundred metres to go, he made a last call to the Hub.

'I've still got some control - will be down in half a minute - will call you then.'

That was optimistic, and everyone knew it. But he refused to say goodbye; he wanted his comrades to know that he had gone down fighting, and without fear.

Indeed, he felt very little fear, and this surprised him, for he had never thought of himself as a particularly brave man. It was almost as if he was watching the struggles of a complete stranger, and was not himself personally involved. Rather, he was studying an interesting problem in aerodynamics, and changing various parameters to see what would happen. Almost the only emotion he felt was a certain remote regret for lost opportunities - of which the most important was the forthcoming Lunar Olympics. One future at least was decided; Dragonfly would never show her paces on the Moon.

A hundred metres to go; his ground speed seemed acceptable, but how fast was he falling? And here was one piece of luck - the terrain was completely flat. He would put forth all his strength in a final burst of power, starting - NOW!

The right wing, having done its duty, finally tore off at the roots. Dragonfly started to roll over, and he tried to correct by throwing the weight of his body against the spin. He was looking directly at the curving arch of landscape sixteen kilometres away when he hit.

It seemed altogether unfair and unreasonable that the sky should be so hard.

CHAPTER TWENTY-NINE - First Contact

When Jimmy Pak returned to consciousness, the first thing he became aware of was a splitting headache. He almost welcomed it; at least it proved that he was still alive.

Then he tried to move, and at once a wide selection of aches and pains brought themselves to his attention. But as far as he could tell, nothing seemed to be broken.

After that, he risked opening his eyes, but closed them at once when he found himself staring straight into the band of light along the ceiling of the world. As a cure for headache, that view was not recommended.

He was still lying there, regaining his strength and wondering how soon it would be safe to open his eyes, when there was a sudden crunching noise from close at hand. Turning his head very slowly towards the source of the sound, he risked a look - and almost lost consciousness again.

Not more than five metres away, a large crab-like creature was apparently dining on the wreckage of poor Dragonfly. When Jimmy recovered his wits he rolled slowly and quietly away from the monster, expecting at every moment to be seized by its claws, when it discovered that more appetizing fare was available. However, it took not the slightest notice of him; when he had increased their mutual separation to ten metres, he cautiously propped himself up in a sitting position.

From this greater distance, the thing did not appear quite so formidable. It had a low, flat body about two metres long and one wide, supported on six triple-jointed legs. Jimmy saw that he was mistaken in assuming that it had been eating Dragonfly; in fact, he could not see any sign of a mouth. The creature was actually doing a neat job of demolition, using scissor-like claws to chop the skybike into small pieces. A whole row of manipulators, which looked uncannily like tiny human hands, then transferred the fragments to a steadily growing pile on

the animal's back.

But was it an animal? Though that had been Jimmy's first reaction, now he had second thoughts. There was a purposefulness about its behaviour which suggested fairly high intelligence; he could see no reason why any creature of pure instincts should carefully collect the scattered pieces of his sky-bike - unless, perhaps, it was gathering material for a nest.

Keeping a wary eye on the crab, which still ignored him completely, Jimmy struggled to his feet. A few wavering steps demonstrated that he could still walk, though he was not sure if he could outdistance those six legs. Then he switched on his radio, never doubting that it would be operating. A crash that he could survive would not even have been noticed by its solid-state electronics.

'Hub Control,' he said softly. 'Can you receive me?'

'Thank God! Are you OK?'

'Just a bit shaken. Take a look at this.'

He turned his camera towards the crab, just in time to record the final demolition of Dragonfly's wing.

'What the devil is it - and why is it chewing up your bike?'

'Wish I knew. It's finished with Dragonfly. I'm going to back away, in case it wants to start on me.'

Jimmy slowly retreated, never taking his eyes off the crab. It was now moving round .and round in a steadily widening spiral, apparently searching for fragments it might have overlooked, and so Jimmy was able to get an overall view of it for the first time.

Now that the initial shock had worn off, he could appreciate that it was quite a handsome beast. The name 'crab' which he had automatically given it was perhaps a little misleading; if it had not been so impossibly large, he might have called it a beetle. Its carapace had a beautiful metallic sheen; in fact, he would almost have been prepared to swear that it was metal.

That was an interesting idea. Could it be a robot, and not an animal? He stared at the crab intently with this thought in mind, analysing all the details of its anatomy. Where it should have had a mouth was a collection of manipulators that reminded Jimmy strongly of the multi-purpose knives that are the delight of all red-blooded boys; there were pinchers, probes, rasps and even something that looked like a drill. But none of this was decisive. On Earth, the insect world had matched all these tools, and many more. The animal-or-robot question re-

mained in perfect balance in his mind.

The eyes, which might have settled the matter, left it even more ambiguous. They were so deeply recessed in protective hoods that it was impossible to tell whether their lenses were made of crystal or jelly. They were quite expressionless and of a startlingly vivid blue. Though they had been directed towards Jimmy several times, they had never shown the slightest flicker of interest. In his perhaps biased opinion, that decided the level of the creature's intelligence. An entity - robot or animal - which could ignore a human being could not be very bright.

It had now stopped its circling, and stood still for a few seconds, as if listening to some inaudible message. Then it set off, with a curious rolling gait, in the general direction of the Sea. It moved in a perfectly straight line at a steady four or five kilometres an hour, and had already travelled a couple of hundred metres before Jimmy's still slightly-shocked mind registered the fact that the last sad relics of his beloved Dragonfly were being carried away from him. He set off in a hot and indignant pursuit.

His action was not wholly illogical. The crab was heading towards the Sea - and if any rescue was possible, it could only be from this direction. Moreover, he wanted to discover what the creature would do with its trophy; that should reveal something about its motivation and intelligence.

Because he was still bruised and stiff, it took Jimmy several minutes to catch up with the purposefully-moving crab. When he had done so, he followed it at a respectful distance, until he felt sure that it did not resent his presence. It was then - that he noticed his water-flask and emergency ration pack among the debris of Dragonfly, and instantly felt both hungry and thirsty.

There, scuttling away from him at a remorseless five kilometres an hour, was the only food and drink in all this half of the world. Whatever the risk, he had to get hold of it.

He cautiously closed in on the crab, approaching from right rear. While he kept station with it, he studied the complicated rhythm of its legs, until he could anticipate where they would be at any moment. When he was ready, he muttered a quick 'Excuse me,' and shot swiftly in to grab his property. Jimmy had never dreamed that he would one day have to exercise the skills of a pickpocket, and was delighted with his success. He was out again in less than a second, and the crab never slackened its steady pace.

He dropped back a dozen metres, moistened his lips from the flask, and started to chew a bar of meat concen-

trate. The little victory made him feel much happier; now he could even risk thinking about his sombre future.

While there was life, there was hope; yet he could imagine no way in which he could possibly be rescued. Even if his colleagues crossed the Sea, how could he reach them, half a kilometre below? 'We'll find a way down somehow,' Hub Control had promised. 'That cliff can't go right round the world, without a break anywhere.' He had been tempted to answer 'Why not?', but had thought better of it.

One of the strangest things about walking inside Rama was that you could always see your destination. Here, the curve of the world did not hide - it revealed. For some time Jimmy had been aware of the crab's objective; up there in the land which seemed to rise before him was a half-kilometre-wide pit. It was one of three in the southern continent; from the Hub, it had been impossible to see how deep they were. All had been named after prominent lunar craters, and he was approaching Copernicus. The name was hardly appropriate, for there were no surrounding hills and no central peaks. This Copernicus was merely a deep shaft or well, with perfectly vertical sides.

When he came close enough to look into it, Jimmy was able to see a pool of ominous, leaden-green water at least half a kilometre below. This would put it just about level with the Sea, and he wondered if they were connected.

Winding down the interior of the well was a spiral ramp, completely recessed into the sheer wall, so that the effect was rather like that of rifling in an immense gun-barrel. There seemed to be a remarkable number of turns; not until Jimmy had traced them for several revolutions, getting more and more confused in the process, did he realize that there was not one ramp but three, totally independent and 120 degrees apart. In any other background than Rama, the whole concept would have been an impressive architectural tour de force.

The three ramps led straight down into the pool and disappeared beneath its opaque surface. Near the waterline Jimmy could see a group of black tunnels or caves; they looked rather sinister, and he wondered if they were inhabited. Perhaps the Ramans were amphibious...

As the crab approached the edge of the well, Jimmy assumed that it was going to descend one of the ramps - perhaps taking the wreckage of Dragonfly to some entity who would be able to evaluate it. Instead, the creature walked straight to the brink, extended almost half its body over the gulf without any sign of hesitation, though an error of a few centimetres would have been disastrous - and gave a brisk shrug. The fragments of Dragonfly went fluttering down into the depths; there were tears in Jimmy's eyes as he watched them go. So much, he thought

bitterly, for this creature's intelligence.

Having disposed of the garbage, the crab swung around and started to walk towards Jimmy, standing only about ten metres away. Am I going to get the same treatment? he wondered. He hoped the camera was not too unsteady as he showed Hub Control the rapidly approaching monster. 'What do you advise?' he whispered anxiously, without much hope that he would get a useful answer. It was some small consolation to realize that he was making history, and his mind raced through the approved patterns for such a meeting. Until now, all of these had been purely theoretical. He would be the first man to check them in practice.

'Don't run until you're sure it's hostile', Hub Control whispered back at him. Run where? Jimmy asked himself. He thought he could out-distance the thing in a hundred metre sprint, but had a sick certainty that it could wear him down over the long haul.

Slowly, Jimmy held up his outstretched hands. Men had been arguing for two hundred years about this gesture; would every creature, everywhere in the universe, interpret this as 'See no weapons?' But no one could think of anything better.

The crab showed no reaction whatsoever, nor did it slacken its pace. Ignoring Jimmy completely, it. walked straight past him and headed purposefully into the south. Feeling extremely foolish, the acting representative of Homo sapiens watched his First Contact stride away across the Raman plain, totally indifferent to his presence.
- He had seldom been so humiliated in his life. Then Jimmy's sense of humour came to his rescue. After all, it was no great matter to have been ignored by an animated garbage truck. It would have been worse if it had greeted him as a long-lost brother...

He walked back to the rim of Copernicus, and stared down into its opaque waters. For the first time, he noticed that vague shapes - some of them quite large - were moving slowly back and forth beneath the surface. Presently one of them headed towards the nearest spiral ramp, and something that looked like a multi-legged tank started on the long ascent. At the rate it was going, Jimmy decided, it would take almost an hour to get here; if it was a threat, it was a very slow-moving one.
- Then he noticed a flicker of much more rapid movement, near those cave-like openings down by the waterline. Something was travelling very swiftly along the ramp, but he could not focus clearly upon it, or discern any definite shape. It was as if he was looking at a small whirlwind or 'dust-devil', about the size of a man ...

He blinked and shook his head, keeping his eyes closed

for several seconds. When he opened them again, the apparition was gone.

Perhaps the impact had shaken him up more than he had realized; this was the first time he had ever suffered from visual hallucinations. He would not mention it to Hub Control.

Nor would he bother to explore those ramps, as he had half-thought of doing. It would obviously be a waste of energy.

The spinning phantom he had merely imagined seeing had nothing to do with his decision.

Nothing at all; for, of course, Jimmy did not believe in ghosts.

CHAPTER THIRTY- The Flower

Jimmy's exertions had made him thirsty, and he was acutely conscious of the fact that in all this land there was no water that a man could drink. With the contents of his flask, he could probably survive a week - but for what purpose? The best brains of Earth would soon be focused on his problem; doubtless Commander Norton would be bombarded with suggestions. But he could imagine no way in which he could lower himself down the face of that half-kilometre cliff. Even it he had a long enough rope, there was nothing to which he could attach it.

Nevertheless, it was foolish - and unmanly - to give up without a struggle. Any help would have to come from the Sea, and while he was marching towards it he could carry on with his job as if nothing had happened. No one else would ever observe and photograph the varied terrain through which he must pass, and that would guarantee a posthumous immortality. Though he would have preferred many other honours, that was better than nothing.

He was only three kilometres from the Sea as poor Dragonfly could have flown, but it seemed unlikely that he could reach it in a straight line; some of the terrain ahead of him might prove too great an obstacle. That was no problem, however, as there were plenty of alternative routes. Jimmy could see them all, spread out on the great curving map that swept up and away from him on either side.

He had plenty of time; he would start with the most interesting scenery, even if it took him off his direct route. About a kilometre away towards the right was a square that glittered like cut glass - or a gigantic display of jewellery. It was probably this thought that triggered

Jimmy's footsteps. Even a doomed man might reasonably be expected to take some slight interest in a few thousand square metres of gems.

He was not particularly disappointed when they turned out to be quartz crystals, millions of them, set in a bed of sand. The adjacent square of the checkerboard was rather more interesting, being covered with an apparently random pattern of hollow metal columns, set very close together and ranging in height from less than one to more than five metres. It was completely impassable; only a tank could have crashed through that forest of tubes.

Jimmy walked between the crystals and the columns until he came to the first crossroads. The square on the right was a huge rug or tapestry made of woven wire; he tried to prise a strand loose, but was unable to break it.

On the left was a tessellation of hexagonal tiles, so smoothly inlaid that there were no visible joints between them. It would have appeared a continuous surface, had the tiles not been coloured all the hues of the rainbow. Jimmy spent many minutes trying to find two adjacent tiles of the same colour, to see if he could then distinguish their boundaries, but he could not find a single example of such coincidence.

As he did a slow pan right around the crossroads, he said plaintively to Hub Control: 'What do you think this is? I feel I'm trapped in a giant jigsaw puzzle. Or is this the Raman Art Gallery?'

'We're as baffled as you, Jimmy. But there's never been any sign that the Ramans go in for art. Let's wait until we have some more examples before we jump to any conclusions.'

The two examples he found at the next crossroads were not much help. One was completely blank - a smooth, neutral grey, hard but slippery to the touch. The other was a soft sponge, perforated with billions upon billions of tiny holes. He tested it with his foot, and the whole surface undulated sickeningly beneath him like a barely stabilized quicksand.

At the next cross-roads he encountered something strikingly like a ploughed field - except that the furrows were a uniform metre in depth, and the material of which they were made had the texture of a file or rasp. But he paid little attention to this, because the square adjacent to it was the most thought-provoking of all that he had so far met. At last there was something that he could understand; and it was more than a little disturbing.

The entire square was surrounded by a fence, so conventional that he would not have looked at it twice had

he seen it on Earth. There were posts - apparently of metal - five metres apart, with six strands of wire strung taut between them.

Beyond this fence was a second, identical one - and beyond that, a third. It was another typical example of Raman redundancy; whatever was penned inside this enclosure would have no chance of breaking out. There was no entrance - no gates that could be swung open to drive in the beast, or beasts, that were presumably kept here. Instead, there was a single hole, like a smaller version of Copernicus, in the centre of the square.

Even in different circumstances, Jimmy would probably not have hesitated, but now he had nothing to lose. He quickly scaled all three fences, walked over to the hole, and peered into it.

Unlike Copernicus, this well was only fifty metres deep. There were three tunnel exits at the bottom, each of which looked large enough to accommodate an elephant. And that was all.

After staring for some time, Jimmy decided that the only thing that made sense about the arrangement was for the floor down there to be an elevator. But what it elevated he was never likely to know; he could only guess that it was quite large, and possibly quite dangerous.

During the next few hours, he walked more than ten kilometres along the edge of the Sea, and the checkerboard squares had begun to blur together in his memory. He had seen some that were totally enclosed in tent-like structures of wire mesh, as if they were giant bird-cages. There were others which seemed to be pools of congealed liquid, full of swirl-patterns; however, when he tested them gingerly, they were quite solid. And there was one so utterly black that he could not even see it clearly; only the sense of touch told him that anything was there.

Yet now there was a subtle modulation into something he could understand. Ranging one after the other towards the south was a series of - no other word would do - fields. He might have been walking past an experimental farm on Earth; each square was a smooth expanse of carefully levelled earth, the first he had ever seen in the metallic landscapes of Rama.

The great fields were virgin, lifeless - waiting for crops that had never been planted. Jimmy wondered what their purpose could be, since it was incredible that creatures as advanced as the Ramans would engage in any form of agriculture; even on Earth, farming was no more than a popular hobby and a source of exotic luxury foods. But he could swear that these were potential farms, immaculately prepared. He had never seen earth that

looked so clean; each square was covered with a great sheet of tough, transparent plastic. He tried to cut through it to obtain a sample, but his knife would barely scratch the surface.

Further inland were other fields, and on many of them were complicated constructions of rods and wires, presumably intended for the support of climbing plants. They looked very bleak and desolate, like leafless trees in the depths of winter. The winter they had known must have been long and terrible indeed, and these few weeks of light and warmth might be only a brief interlude before it came again.

Jimmy never knew what made him stop and look more closely into the metal maze to the south. Unconsciously, his mind must have been checking every detail around him; it had noticed, in this fantastically alien landscape, something even more anomalous.

About a quarter of a kilometre away, in the middle of a trellis of wires and rods, glowed a single speck of colour. It was so small and inconspicuous that it was almost at the limit of visibility; on Earth, no one would have looked at it twice. Yet undoubtedly one of the reasons he had noticed it now was because it reminded him of Earth ...

He did not report to Hub Control until he was sure that there was no mistake, and that wishful thinking had not deluded him. Not until he was only a few metres away could he be completely sure that life as he knew it had intruded into the sterile, aseptic world of Rama. For blooming here in lonely splendour at the edge of the southern continent was a flower.

As he came closer, it was obvious to Jimmy that something had gone wrong. There was a hole in the sheathing that, presumably, protected this layer of earth from contamination by unwanted life-forms. Through this break extended a green stem, about as thick as a man's little finger, which twined its way up through the trellis-work. A metre from the ground it burst into an efflorescence of bluish leaves, shaped more like feathers than the foliage of any plant known to Jimmy. The stem ended, at eye-level, in what he had first taken to be a single flower. Now he saw, with no surprise at all, that it was actually three flowers tightly packed together.

The petals were brightly coloured tubes about five centimetres long; there were at least fifty in each bloom, and they glittered with such metallic blues, violets and greens, that they seemed more like the wings of a butterfly than anything in the vegetable kingdom. Jimmy knew practically nothing about botany, but he was puzzled to see no trace of any structures resembling petals or stamens. He wondered if the likeness to terrestrial flowers

might be a pure coincidence; perhaps this was something more akin to a coral polyp. In either case, it would seem to imply the existence of small, airborne creatures to serve either as fertilizing agents - or as food.

It did not really matter. Whatever the scientific definition, to Jimmy this was a flower. The strange miracle, the un-Raman-like accident of its existence here reminded him of all that he would never see again; and he was determined to possess it.

That would not be easy. It was more than ten metres away, separated from him by a lattice-work made of thin rods. They formed a cubic pattern, repeated over and over again, less than forty centimetres on either side. Jimmy would not have been flying sky-bikes unless he had been slim and wiry, so he knew he could crawl through the interstices of the grid. But getting out again might be quite a different matter; it would certainly be impossible for him to turn around, so he would have to retreat backwards.

Hub Control was delighted with his discovery, when he had described the flower and scanned it from every available angle. There was no objection when he said: 'I'm going after it.' Nor did he expect there to be; his life was now his own, to do with as he pleased.

He stripped off all his clothes, grasped the smooth metal rods, and started to wriggle into the framework. It was a tight fit; he felt like a prisoner escaping through the bars of his cell. When he had inserted himself completely into the lattice he tried backing out again, just to see if there were any problems. It was considerably more difficult, since he now had to use his outstretched arms for pushing instead of pulling, but he saw no reason why he should get helplessly trapped.

Jimmy was a man of action and impulse, not of introspection. As he squirmed uncomfortably along the narrow corridor of rods, he wasted no time asking himself just why he was performing so quixotic a feat. He had never been interested in flowers in his whole life, yet now he was gambling his last energies to collect one.

It was true that this specimen was unique, and of enormous scientific value. But he really wanted it because it was his last link with the world of life and the planet of his birth.

Yet when the flower was in his grasp, he had sudden qualms. Perhaps it was the only flower that grew in the whole of Rama; was he justified in picking it?

If he needed any excuse, he could console himself with the thought that the Ramans themselves had not included it in their plans. It was obviously a freak, growing ages too late - or too soon. But lie did not really require

an excuse, and his hesitation was only momentary. He reached out, grasped the stem, and gave a sharp jerk.

The flower came away easily enough; he also collected two of the leaves, then started to back slowly through the lattice. Now that he had only one free hand, progress was extremely difficult, even painful, and he soon had to pause to regain his breath. It was then that he noticed that the feathery leaves were closing, and the headless stem was slowly unwinding itself from its supports. As he watched with a mixture of fascination and dismay, he saw that the whole plant was steadily retreating into the ground, like a mortally injured snake crawling back into its hole.

I've murdered something beautiful, Jimmy told himself. But then Rama had killed him. He was only collecting what was his rightful due.

CHAPTER THIRTY-ONE - Terminal Velocity

Commander Norton had never yet lost a man, and he had no intention of starting now. Even before Jimmy had set off for the South Pole, he had been considering ways of rescuing him in the event of accident; the problem, however, had turned out to be so difficult that he had found no answer. All that he had managed to do was to eliminate every obvious solution.

How does one climb a half-kilometre vertical cliff; even in reduced gravity? With the right equipment - and training - it would be easy enough. But there were no piton-guns aboard Endeavour, and no one could think of any other practical way of driving the necessary hundreds of spikes into that hard, mirror surface.

He had glanced briefly at more exotic solutions, some frankly crazy. Perhaps a simp, fitted with suction pads, could make the ascent. But even if this scheme was practical, how long would it take to manufacture and test such equipment - and to train a simp to use it? He doubted if a man would have the necessary strength to perform the feat.

Then there was more advanced technology. The EVA propulsion units were tempting, but their thrust was too small, since they were designed for zero-gee operation. They could not possibly lift the weight of a man, even against Rama's modest gravity.

Could an EVA thrust be sent up on automatic control, carrying only a rescue line? He had tried out this idea on Sergeant Myron, who had promptly shot it down in flames. There were, the engineer pointed out, severe stability problems; they might be solved, but it would take a long time - much longer than they could afford.

What about balloons? There seemed a faint possibility here, if they could devise an envelope and a sufficiently compact source of heat. This was the only approach that Norton had not dismissed, when the problem suddenly ceased to be one of theory, and became a matter of life and death, dominating the news in all the inhabited worlds.

While Jimmy was making his trek along the edge of the Sea, half the crackpots in the solar system were trying to save him. At Fleet Headquarters, all the suggestions were considered, and about one in a thousand was forwarded to Endeavour. Dr Carlisle Perera' arrived twice - once via the Survey's own network, and once by PLANETCOM, RAMA PRIORITY. It had taken the scientist approximately five minutes of thought and one millisecond of computer time.

At first, Commander Norton thought it was a joke in very poor taste. Then he saw the sender's name and the attached calculations, and did a quick double-take.

He handed the message to Karl Mercer.

'What do you think of this?' he asked, in as non-committal a tone of voice as he could manage.

Karl read it swiftly, then said, 'Well I'm damned! He's right, of course.'

'Are you sure?'

'He was right about the storm, wasn't he? We should have thought of this; it makes me feel a fool.'

'You have company. The next problem is - how do we break it to Jimmy?'

'I don't think we should ... until the last possible minute. That's how I'd prefer it, if I was in his place. Just tell him we're on the way.'
Though he could look across the full width of the Cylindrical Sea, and knew the general direction from which Resolution was coming, Jimmy did not spot the tiny craft until it had already passed New York. It seemed incredible that it could carry six men - and whatever equipment they had brought to rescue him.

When it was only a kilometre away, he recognized Commander Norton, and started waving. A little later the skipper spotted him, and waved back.

'Glad to see you're in good shape, Jimmy,' he radioed. 'I promised we wouldn't leave you behind. Now do you believe me?'

Not quite, Jimmy thought; until this moment he had

still wondered if this was all a kindly plot to keep up his morale. But the Commander would not have crossed the Sea just to say goodbye; he must have worked out something.

'I'll believe you, Skipper,' he said, 'when I'm down there on the deck. Now will you tell me how I'm going to make it?'

Resolution was now slowing down, a hundred metres from the base of the cliff; as far as Jimmy could tell, she carried no unusual equipment - though he was not sure what he had expected to see.

'Sorry about that, Jimmy - but we didn't want you to have too many things to worry about.'

Now that sounded ominous; what the devil did he mean?

Resolution came to a halt, fifty metres out and five hundred below; Jimmy had almost a bird's-eye view of the Commander as he spoke into his microphone.

'This is it, Jimmy. You'll be perfectly safe, but it will require nerve. We know you've got plenty of that. You're going to jump.'

'Five hundred metres!'

'Yes, but at only half a gee.'

'So - have you ever fallen two hundred and fifty on Earth?'

'Shut up, or I'll cancel your next leave. You should have worked this out for yourself... it's just a question of terminal velocity. In this atmosphere, you can't reach more than ninety kilometres an hour - whether you fall two hundred or two thousand metres. Ninety's a little high for comfort, but we can trim it some more. This is what you'll have to do, so listen carefully...'

'I will,' said Jimmy. 'It had better be good.'

He did not interrupt the Commander again, and made no comment when Norton had finished. Yes, it made sense, and was so absurdly simple that it would take a genius to think of it. And, perhaps, someone who did not expect to do it himself...

Jimmy had never tried high-diving, or made a delayed parachute drop, which would have given him some psychological preparation for this feat. One could tell a man that it was perfectly safe to walk a plank across an abyss - yet even if the structural calculations were impeccable, he might still be unable to do it. Now Jimmy understood

why the Commander had been so evasive about the details of the rescue. He had been given no time to brood, or to think of objections.

'I don't want to hurry you,' said Norton's persuasive voice from half a kilometre below. 'But the sooner the better.'

Jimmy looked at his precious souvenir, the only flower in Rama. He wrapped it very carefully in his grimy handkerchief, knotted the fabric, and tossed it over the edge of the cliff.

It fluttered down with reassuring slowness, but it also took a very long time getting smaller, and smaller, and smaller, until he could no longer see it. But then Resolution surged forward, and he knew that it had been spotted.

'Beautiful!' exclaimed the Commander enthusiastically. 'I'm sure they'll name it after' you. OK - we're waiting...

Jimmy stripped off his shirt - the only upper garment anyone ever wore in this now tropical climate - and stretched it thoughtfully. Several times on his trek he life.

For the last time, he looked back at the hollow world he alone had explored, and the distant, ominous pinnacles of the Big and Little Horns. Then, grasping the shirt firmly with his right hand, he took a running jump as far out over the cliff as he could.

Now there was no particular hurry; he had a full twenty seconds in which to enjoy the experience. But he did not waste any time, as the wind strengthened around him and Resolution slowly expanded in his field of view. Holding his shirt with both hands, he stretched his arms above his. head, so that the rushing air filled the garment and blew it into a hollow tube.

As a parachute, it was hardly a success; the few kilometres an hour it subtracted from his speed was useful, but not vital. It was doing a much more important job - keeping his body vertical, so that he would arrow straight into the sea.

He still had the impression that he was not moving at all, but that the water below was rushing up towards him. Once he had committed himself, he had no sense of fear; indeed, he felt a certain indignation against the skipper for keeping him in the dark. Did he really think that he would be scared to jump, if he had to brood over it too long?

At the very last moment, he let go of his shirt, took a

deep breath, and grabbed his mouth and nose with his hands. As he had been instructed, he stiffened his body into a rigid bar, and locked his feet together. He would enter the water as cleanly as a falling spear...

'It will be just the same,' the Commander had promised, 'as stepping off a diving board on Earth. Nothing to it - if you make a good entry.'

'And if I don't?' he had asked.

'Then you'll have to go back and try again.'

Something slapped him across the feet - hard, but not viciously. A million slimy hands were tearing at his body; even though his eyes were tightly closed, he could tell that darkness was falling as he arrowed down into the depths of the Cylindrical Sea.

With all his strength, he started to swim upwards towards the fading light. He could not open his, eyes for more than a single blink; the poisonous water felt like acid when he did so. He seemed to have been struggling for ages, and more than once he had a nightmare fear that he had lost his orientation and was really swimming downwards. Then he would risk another quick glimpse, and every time the light was stronger.

His eyes were still clenched tightly shut when he broke water. He gulped a precious mouthful of air, rolled over on his back, and looked around.

Resolution was heading towards him at top speed; within seconds, eager hands had grabbed him and dragged him aboard.

'Did you swallow any water?' was the Commander's anxious question.

'I don't think so.'

'Rinse out with this, anyway. That's fine. How do you feel?'

'I'm not really sure. I'll let you know in a minute. Oh ... thanks, everybody.' The minute was barely up when Jimmy was only too sure how lie felt.

'I'm going to be sick,' he confessed miserably. His rescuers were incredulous.

'In a dead calm - on a flat sea?' protested Sergeant Barnes, who seemed to regard Jimmy's plight as a direct reflection on her skill.

'I'd hardly call it flat,' said the Commander, waving his arm around the band of water that circled the sky. 'But

don't be ashamed - you may have swallowed some of that stuff. Get rid of it as quickly as you can.

Jimmy was still straining, unheroically and unsuccessfully, when there was a sudden flicker of light in the sky behind them. All eyes turned towards the South Pole, and Jimmy instantly forgot his sickness. The Horns had started their firework display again.

There were the kilometre-long streamers of fire, dancing from the central spike to its smaller companions. Once again they began their stately rotation, as if invisible dancers were winding their ribbons around an electric maypole. But now they began to accelerate, moving faster and faster until they blurred into a flickering cone of light.

It was a spectacle more awe-inspiring than any they had yet seen here, and it brought with it a distant crackling roar which added to the impression of overwhelming power. The display lasted for about five minutes; then it stopped as abruptly as if someone had turned a switch.

'I'd like to know what the Rama Committee make of that,' Norton muttered to no one in particular. 'Has anyone here got any theories?'

There was no time for an answer, because at that moment Hub Control called in great excitement.

'Resolution! Are you OK? Did you feel that?'

'Feel what?'

'We think it was an earthquake - it must have happened the minute those fireworks stopped.'

'Any damage?'

'I don't think so. It wasn't really violent - but it shook us up a bit.'

'We felt nothing at all. But we wouldn't, out here in the Sea.'

'Of course, silly of me. Anyway, everything seems quiet now ... until next time.'

'Yes, until the next time,' Norton echoed. The mystery of Rama was steadily growing; the more they discovered about it, the less they understood.

There was a sudden shout from the helm.

'Skipper - look - up there in the sky!'

Norton lifted his eyes, swiftly scanning the circuit of the Sea. He saw nothing, until his gaze had almost reached the zenith, and he was staring at the other side of the world. -

'My God,' he whispered slowly, as he realized that the 'next time' was already almost here.

A tidal wave was racing towards them, down the eternal curve of the Cylindrical Sea.

CHAPTER THIRTY-TWO - The Wave

Yet even in that moment of shock, Norton's first concern was for his ship.

'Endeavour!' he called. 'Situation report!'

'All OK, Skipper,' was the reassuring answer from the Exec. 'We felt a slight tremor, but nothing that could cause any damage. There's been a small change of attitude - the bridge says about point two degrees. They also think the spin rate has altered slightly - we'll have an accurate reading on that in a couple of minutes.'

So it's beginning to happen, Norton told himself, and a lot earlier than we expected; we're still a long way from perihelion, and the logical time for an orbit change. But some kind of trim was undoubtedly taking place - and there might be more shocks to come.

Meanwhile, the effects of this first one were all too obvious, up there on the curving sheet of water which seemed perpetually falling from the sky. The wave was still about ten kilometres away, and stretched the full width of the Sea from northern to southern shore. Near the land, it was a foaming wall of white, but in deeper water it was a barely visible blue line, moving much faster than the breakers on either flank. The drag of the shoreward shallows was already bending it into a bow, with the central portion getting further and further ahead.

'Sergeant,' said Norton urgently. 'This is your job. What can we do?'

Sergeant Barnes had brought the raft completely to rest and was studying the situation intently. Her expression, Norton was relieved to see, showed no trace of alarm - rather a certain zestful excitement, like a skilled athlete about to accept a challenge.

'I wish we had some soundings,' she said. 'If we're in deep water, there's nothing to worry about.'

'Then we're all right. We're still four kilometres from shore.'

'I hope so, but I want to study the situation.'

She applied power again, and swung Resolution around until it was just under way, heading directly towards the approaching wave. Norton judged that the swiftly moving central portion would reach them in less than five minutes, but he could also see that it presented no serious danger. It was only a racing ripple a fraction of a metre high, and would scarcely rock the boat. The walls of foam lagging far behind it were the real menace.

Suddenly, in the very centre of the Sea, a line of breakers appeared. The wave had. clearly hit a submerged wall, several kilometres in length, not far below the surface. At the same time; the breakers on the two flanks collapsed, as they ran into deeper water.

Anti-slosh plates, Norton told himself. Exactly the same as in Endeavour's own propellant tanks - but on a thousand-fold greater scale. There must be a complex pattern of them all around the Sea, to damp out any waves as quickly as possible. The only thing that matters now is: are we right on top of one?

Sergeant Barnes was one jump ahead of him. She brought Resolution to a full stop and threw out the anchor. It hit bottom at only five metres.

'Haul it up!' she called to her crewmates. 'We've got to get away from here!'

Norton agreed heartily; but in which direction? The Sergeant was headed full speed towards the wave, which was now only five kilometres away. For the first time, he could hear the sound of its approach - a distant, unmistakable roar which he had never expected to hear inside Rama. Then it changed in intensity; the central portion was collapsing once more - and the flanks were building up again.

He tried to estimate the distance between the submerged baffles, assuming that they were spaced at equal intervals. If he was right, there should be one more to come; if they could station the raft in the deep water between them, they would be perfectly safe.

Sergeant Barnes cut the motor, and threw out the anchor again. It went down thirty metres without hitting bottom.

"We're OK,' she said, with a sigh of relief. 'But I'll keep the motor running.'

Now there were only the lagging walls of foam along the coast; out here in the central Sea it was calm again, apart from the inconspicuous blue ripple still speeding

towards them. The Sergeant was just holding Resolution on course towards the disturbance, ready to pour on full power at a moment's notice.

Then, only two kilometres ahead of them, the Sea started to foam once more. It humped up in white-maned fury, and now its roaring seemed to fill the world. Upon the sixteen-kilometre-high wave of the Cylindrical Sea, a smaller ripple was superimposed, like an avalanche thundering down a mountain slope. And that ripple was quite large enough to kill them.

Sergeant Barnes must have seen the expressions on the faces of her crewmates. She shouted above the roar: 'What are you scared about? I've ridden bigger ones than this.' That was not quite true; nor did she add that her earlier experience had been in a well-built surf-boat, not an improvised raft. 'But if we have to jump, wait until I tell you. Check your life-jackets.'

She's magnificent, thought the Commander - obviously enjoying every minute, like a Viking warrior going into battle. And she's probably right - unless we've miscalculated badly.

The wave continued to rise, curving upwards and over. The slope above them probably exaggerated its height, but it looked enormous - an irresistible force of nature that would overwhelm everything in its path.

Then, within seconds, it collapsed, as if its foundations had been pulled out from underneath it. It was over the submerged barrier, in deep water again. When it reached them a minute later Resolution merely bounced up and down a few times before Sergeant Barnes swung the raft around and set off at top speed towards the north.

'Thanks, Ruby - that was splendid. But will we get home before it comes round for the second time?'

'Probably not; it will be back in about twenty minutes. But it will have lost all its strength then; we'll scarcely notice it.'

Now that the Wave had passed, they could relax and enjoy the voyage - though no one would be completely at ease until they were back on land. The disturbance had left the water swirling round in random eddies, and had also stirred up a most peculiar acidic smell - 'like crushed ants', as Jimmy aptly put it. Though unpleasant, the odour caused none of the attacks of sea-sickness that might have been expected; it was something so alien that human physiology could not respond to it.

A minute later, the wave front hit the next underwater barrier, as it climbed away from them and up the sky. This time, seen from the rear, the spectacle was unim-

pressive and the voyagers felt ashamed of their previous fears. They began to feel themselves masters of the Cylindrical Sea.

The shock was therefore all the greater when, not more than a hundred metres away, something like a slowly rotating wheel began to rear up out of the water. Glittering metallic spokes. five metres long, emerged dripping from the sea, spun for a moment in the fierce Raman glare, and splashed back into the water. It was 'as if a giant starfish with tubular arms had broken the surface.

At first sight, it was impossible to tell whether it was an animal or a machine. Then it flopped over and lay half-awash, bobbing up and down in the gentle aftermath of the wave.

Now they could see that there were nine arms, apparently jointed, radiating from a central disc. Two of the arms were broken, snapped off at the outer joint. The others ended at a complicated collection of manipulators that reminded Jimmy very strongly of the crab he had encountered. The two creatures came from the same line of evolution - or the same drawing-board.

At the middle of the disc was a small turret, bearing three large eyes. Two were closed, one open - and even that appeared to be blank and unseeing. No one doubted that they were watching the death-throes of some strange monster, tossed up to the surface by the submarine disturbance that had just passed.

Then they saw that it was not alone. Swimming round it, and snapping at its feebly moving limbs, were two small beasts like overgrown lobsters. They were efficiently chopping up the monster, and it did nothing to resist, though its own claws seemed quite capable of dealing with the attackers.

Once again, Jimmy was reminded of the crab that had demolished Dragonfly. He watched intently as the one-sided conflict continued, and quickly confirmed his impression.

'Look, Skipper,' he whispered. 'Do you see - they're not eating it. They don't even have any mouths. They're simply chopping it to pieces. That's exactly what happened to Dragonfly.'

'You're right. They're dismantling it - like - like a broken machine.' Norton wrinkled his nose. 'But no dead machine ever smelled like that!'

Then another thought struck him.

'My God - suppose they start on us! Ruby, get us back to shore as quickly as you can!'

Resolution surged forward with reckless disregard for the life of her power cells. Behind them, the nine spokes of the great starfish - they could think of no better name for it - were clipped steadily shorter, and presently the weird tableau sank back into the depths of the Sea.

There was no pursuit, but they did not breathe comfortably again until Resolution had drawn up to the landing stage and they had stepped thankfully ashore. As he looked back across that mysterious and now 'suddenly sinister band of water, Commander Norton grimly determined that no one would ever sail it again. There were too many unknowns, too many dangers...

He looked back upon the towers and ramparts of New York, and the dark cliff of the continent beyond. They were safe now from inquisitive man.

He would not tempt the gods of Rama again.

CHAPTER THIRTY-THREE - Spider

From now on, Norton had decreed, there would always be at least three people at Camp Alpha, and one of them would always be awake. In addition, all exploring parties would follow the same routine. Potentially dangerous creatures were on the move inside Rama, and though none had shown active hostility, a prudent commander would take no chances.

As an extra safeguard, there was always an observer up on the Hub, keeping watch through a powerful telescope. From this vantage point, the whole interior of Rama could be surveyed, and even the South Pole appeared only a few hundred metres away. The territory round any group of explorers was to be kept under regular observation; in this way, it was hoped to eliminate any possibility of surprise. It was a good plan - and it failed completely.

After the last meal of the day, and just before the 22.00 hour sleep period, Norton, Rodrigo, Calvert and Laura Ernst were watching the regular evening news telecast specially beamed to them from the transmitter at Inferno, Mercury. They had been particularly interested in seeing Jimmy's film of the Southern continent, and the return across the Cylindrical Sea - an episode which had excited all viewers. Scientists, news commentators, and members of the Rama Committee had given their opinions, most of them contradictory. No one could agree whether the crab-like creature Jimmy had encountered was an animal, a machine, a genuine Raman - or something that fitted none of these categories.

They had just watched, with a distinctly queasy feeling, the giant starfish being demolished by its predators

when they discovered that they were no longer alone. There was an intruder in the camp.

Laura Ernst noticed it first. She froze in sudden shock, then said: 'Don't move, Bill. Now look slowly to the right.'

Norton turned his head. Ten metres away was a slender-legged tripod surmounted by a spherical body no larger than a football. Set around the body were three large, expressionless eyes, apparently giving g6o degrees of vision, and trailing beneath it were three whiplike tendrils. The creature was not quite as tall as a man, and looked far too fragile to be dangerous, but that did not excuse their carelessness in letting it sneak up on them unawares. It reminded Norton of nothing so much as a three-legged spider, or daddy-long-legs, and he wondered how it had solved the problem - never challenged by any creature on Earth - of tripedal locomotion.

'What do you make of it, Doc?' he whispered, turning off the voice of the TV newscaster.

'Usual Raman three-fold symmetry. I don't see how it could hurt us, though those whips might be unpleasant - and they could be poisonous, like a coelenterate's. Sit tight and see what it does.'

After regarding them impassively for several minutes, the creature suddenly moved - and now they could understand why they had failed to observe its arrival. It was fast, and it covered the ground with such an extraordinary spinning motion that the human eye and mind had real difficulty in following it.

As far as Norton could judge - and only a high-speed camera could settle the matter - each leg in turn acted as a pivot around which the creature whirled its body. And he was not sure, but it also seemed to him that every few 'steps' it reversed its direction of spin, while the three whips flickered over the ground like lightning as it moved. Its top speed - though this also was very hard to estimate - was at least thirty kilometres an hour.

It swept swiftly round the camp, examining every item of equipment, delicately touching the improvised beds and chairs and tables, communication gear, food containers, Electrosans, cameras, water tanks, tools - there seemed to be nothing that it ignored, except the four watchers. Clearly, it was intelligent enough to draw a distinction between humans and their inanimate property; its actions gave the unmistakable impression of an extremely methodical curiosity or inquisitiveness.

'I wish I could examine it!' Laura exclaimed in frustration, as the creature continued its swift pirouette. 'Shall we try to catch it?'

'How?' Calvert asked, reasonably enough.

'You know - the way primitive hunters bring down fast-moving animals with a couple of weights whirling around at the end of a rope. It doesn't even hurt them.'

'That I doubt,' said Norton. 'But even if it worked, we can't risk it. We don't know how intelligent this creature is - and a trick like that could easily break its legs. Then we would be in real trouble - from Rama, Earth and everyone else.'

'But I've got to have a specimen!'

'You may have to be content with Jimmy's flower - unless one of these creatures cooperates with you. Force is out. How would you like it if something landed on Earth and decided that you would make a nice specimen for dissection?'

'I don't want to dissect it,' said Laura, not at all convincingly. 'I only want to examine it.'

'Well, alien visitors might have the same attitude towards you, but you could have a very uncomfortable time before you believed them. We must make no move that could possibly he regarded as threatening.'

He was quoting from Ship's Orders, of course, and Laura knew it. The claims of science had a lower priority than those of space-diplomacy.

In fact, there was no need to bring in such elevated considerations; it was merely a matter of good manners. They were all visitors here, and had never even asked permission to come inside...

The creature seemed to have finished its inspection. It made one more high-speed circuit of the camp, then shot off at a tangent - towards the stairway.

'I wonder how it's going to manage the steps?' Laura mused. Her question was quickly answered; the spider ignored them completely, and headed up the gently sloping curve of the ramp without slackening its speed.

'Hub Control,' said Norton. 'You may have a visitor shortly; take a look at the Alpha Stairway Section Six. And incidentally, thanks a lot for keeping such a good watch on us.'

It took a minute for the sarcasm to sink in; then the Hub observer started to make apologetic noises.

'Er - I can just see something, Skipper, now you tell me it's there. But what is it?'

'Your guess is as good as mine,' Norton answered, as he pressed the General Alert button. 'Camp Alpha calling all stations. We've just been visited by a creature like a three-legged spider, with very thin legs, about two metres high, small spherical body, travels very fast with a spinning motion. Appears harmless but inquisitive. It may sneak up on you before you notice it. Please acknowledge.'

The first reply came from London, fifteen kilometres to the east.

'Nothing unusual here, Skipper.'

The same distance to the west, Rome answered, sounding suspiciously sleepy.

'Same here, Skipper. Uh, just a moment...'

'What is it?'

'I put my pen down a minute ago - it's gone! What - oh!'

'Talk sense!'

'You won't believe this, Skipper. I was making some notes - you know I like writing, and it doesn't disturb anybody - I was using my favourite ball-point, it's nearly two hundred years old - well, now it's lying on the ground, about five metres away! I've got it - thank goodness - it isn't damaged.'

'And how do you suppose it got there?'

'Er - I may have dozed off for a minute. It's been a hard day.'

Norton sighed, but refrained from comment; there were so few of them, and they had so little time in which to explore a world. Enthusiasm could not always overcome exhaustion, and he wondered if they were taking unnecessary risks. Perhaps he should not split his men up into such small groups, and try to cover so much territory. But he was always conscious of the swiftly passing days, and the unsolved mysteries around them. He was becoming more and more certain that something was about to happen, and that they would have to abandon Rama even before it reached perihelion - the moment of truth when any orbit change must surely take place.

'Now listen, Hub, Rome, London - everyone,' he said. 'I want a report at every half-hour through the night. We must assume that from now on we may expect visitors at any time. Some of them may be dangerous, but at all costs we have to avoid incidents. You all know the directives

on this subject.'

That was true enough; it was part of their training - yet perhaps none of them had ever really believed that the long-theorized 'physical contact with intelligent aliens' would occur in their lifetimes - still less that they would experience it themselves.

Training was one thing, reality another; and no one could be sure that the ancient, human instincts of self-preservation would not take over in an emergency. Yet it was essential to give every entity they encountered in Rama the benefit of the doubt, up to the last possible minute-and even beyond.

Commander Norton did not want to be remembered by history as the man who started the first interplanetary war.
Within a few hours there were hundreds of the spiders, and they were all over the plain. Through the telescope, it could be seen that the southern continent was also infested with them - but not, it seemed, the island of New York.

They took no further notice of the explorers, and after a while the explorers took little notice of them - though from time to time Norton still detected a predatory gleam in his Surgeon-Commander's eye. Nothing would please her better, he was sure, than for one of the spiders to have an unfortunate accident, and he would not put it past her to arrange such a thing in the interests of science.

It seemed virtually certain that the spiders could not be intelligent; their bodies were far too small to contain much in the way of brains, and indeed it was hard to see where they stored all the energy to move. Yet their behaviour was curiously purposeful and coordinated; they seemed to be everywhere, but they never visited the same place twice. Norton frequently had the impression that they were searching for something. Whatever it was, they did not seem to have discovered it.

They went all the way up to the central Hub, still scorning the three great stairways. How they managed to ascend the vertical sections, even under almost zero gravity, was not clear; Laura theorized that they were equipped with suction pads.

And then, to her obvious delight, she got her eagerly desired specimen. Hub Control reported that a spider had fallen down the vertical face and was lying, dead or incapacitated, on the first platform. Laura's time up from the plain was a record that would never be beaten.

When she arrived at the platform, she found that, despite the low velocity of impact, the creature had broken all its legs. Its eyes were still? open, but it showed no reac-

tions to any external tests. Even a fresh human corpse would have been livelier, Laura decided; as soon as she got her prize back to Endeavour, she started to work with her dissecting kit.

The spider was so fragile that it almost came to pieces without her assistance. She disarticulated the legs, then started on the delicate carapace, which split along three great circles and opened up like a peeled orange.

After some moments of blank incredulity - for there was nothing that she could recognize or identify - she took a series of careful photographs. Then she picked up her scalpel.

Where to start cutting? She felt like closing her eyes, and stabbing at random, but that would not have been very scientific.

The blade went in with practically no resistance. A second later, Surgeon-Commander Ernst's most unlady-like yell echoed the length and breadth of Endeavour.

It took an annoyed Sergeant McAndrews a good twenty minqtes to calm down the startled simps.

CHAPTER THIRTY-FOUR - His Excellency Regrets...

'As you are all aware, gentlemen,' said the Martian Ambassador, 'a great deal has happened since our last meeting. We have much to discuss - and to decide. I'm therefore particularly sorry that our distinguished colleague from Mercury is not here.'

That last statement was not altogether accurate. Dr Bose was not particularly sorry that HE the Hermian Ambassador was absent. It would have been much more truthful to say that he was worried. All his diplomatic instincts told him that something was happening, and though his sources of information were excellent, he could gather no hints as to what it might be.

The Ambassador's letter of apology had been courteous and entirely uncommunicative. His Excellency had regretted that urgent and unavoidable business had kept him from attending the meeting, either in person or by video. Dr Bose found it very hard to think of anything more urgent - or more important - than Ram a.

'Two of our members have statements to make. 1 would first like to call on Professor Davidson.'

There was a rustle of excitement among the other scientists on the Committee. Most of them had felt that the astronomer, with his well-known cosmic viewpoint, was not the right man to be Chairman of the Space Advisory

Council. He sometimes gave the impression that the activities of intelligent life were an unfortunate irrelevance in the majestic universe of stars and galaxies, and that it was bad manners to pay too much attention to it. This had not endeared him to exobiologists such as Dr Perera, who took exactly the opposite view. To them, the only purpose of the Universe was the production of intelligence, and they were apt to talk sneeringly about purely astrorjomical phenomena. 'Mere dead matter' was one of their favourite phrases.

'Mr Ambassador,' the scientist began, 'I have been analysing the curious behaviour of Rama during the last few days, and would like to present my conclusions. Some of them are rather startling.'

Dr Perera looked surprised, then rather smug. He strongly approved of anything that startled Professor Davidson.

'First of all, there was the remarkable series of events when that young lieutenant flew over to the Southern hemisphere. The electrical discharges themselves, though spectacular, are not important; it is easy to show that they contained relatively little energy. But they coincided with a change in Rama's rate of spin, and its attitude - that is, its orientation in space. This must have involved an enormous amount of energy; the discharges which nearly cost Mr - er Pak his life were merely a minor by-product - perhaps a nuisance that had to be minimized by those giant lightning conductors at the South Pole.

'I draw two conclusions from this. When a spacecraft - and we must call Rama a spacecraft, despite its fantastic size - makes a change of attitude, that usually means it is about to make a change of orbit. We must therefore take seriously the views of those who believe that Rama may be preparing to become another planet of our sun, instead of going back to the st4rs.

'If this is the case, Endeavour must obviously be prepared to cast off - is that what spaceships do? - at a moment's notice. She may be in very serious danger while she is still physically attached to Rama. I imagine that Commander Norton is already well aware of this possibility, but I think we should send him an additional warning.'

'Thank you very much, Professor Davidson. Yes - Dr Solomons?'

'I'd like to comment on that,' said the science historian. 'Rama seems to have made a change of spin without using any jets or reaction devices. This leaves only two possibilities, it seems to me.

'The first one is that it has internal gyroscopes, or their equivalent. They must be enormous; where are they?

'The second possibility - which would turn all our physics upside down - is that it has a reactionless propulsion system. The so-called Space Drive, which Professor Davidson doesn't believe in. If this is the case, Rama may be able to do almost anything. We will be quite unable to anticipate its behaviour, even on the gross physical level.'

The diplomats were obviously somewhat baffled by this exchange, and the astronomer refused to be drawn. He had gone out on enough limbs for one day.

'I'll stick to the laws of physics, if you don't mind, until I'm forced to give them up. If we've not found any gyroscopes in Rama, we may not have looked hard enough, or in the right place.'

Ambassador Bose could see that Dr Perera was getting impatient. Normally, the exobiologist was as happy as anyone else to engage in speculation; but now, for the first time, he had some solid facts. His long-impoverished science had become wealthy overnight.

'Very well - if there are no other comments - I know that Dr Perera has some important information.'

'Thank you, Mr Ambassador. As you've all seen, we have at last obtained a specimen of a Raman life-form, and have observed several others at close quarters. Surgeon-Commander Ernst, Endeavour's medical officer, has sent a full report on the spider-like creature she dissected.

'I must say at once that some of her results are baffling, and in any other circumstances I would have refused to believe them.

'The spider is definitely organic, though its chemistry differs from ours in many respects - it contains considerable quantities of light metals. Yet I hesitate to call it an animal, for several fundamental reasons.

'In the first place, it seems to have no mouth, no stomach, no gut - no method of ingesting food! Also no air intakes, no lungs, no blood, no reproductive system...

'You may wonder what it has got. Well, there's a simple musculature, controlling its three legs and the three whip-like tendrils or feelers. There's a brain - fairly complex, mostly concerned with the creature's remarkably developed triocular vision. But eighty per cent of the body consists of a honeycomb of large cells, and this is what gave Dr Ernst such an unpleasant surprise when she started her dissection. If she'd been luckier she might have

recognized it in time, because it's the one Raman structure that does exist on Earth - though only in a handful of marine animals.

'Most of the spider is simply a battery, very much like that found in electric cells and rays. But in this case, it's apparently not used for defence. It's the creature's source of energy. And that is why it has no provisions for eating and breathing; it doesn't need such primitive arrangements. And incidentally, this means that it would be perfectly at home in a vacuum...

'So we have a creature which, to all intents and purposes, is nothing more than a mobile eye. It has no organs of manipulation; those tendrils are much too feeble. If I had been given its specifications, I would have said it was merely a reconnaissance device.

'Its behaviour certainly fits that description. All the spiders ever do is to run around and look at things. That's all they can do ...

'But the other animals are different. The crab, the starfish, the sharks - for want of better words - can obviously manipulate their environment and appear to be specialized for various functions. I assume that they are also electrically powered since, like the spider, they appear to have no mouths.

'I'm sure you'll appreciate the biological problems raised by all this. Could such creatures evolve naturally? I really don't think so. They appear to be designed like machines, for specific jobs. If I had to describe them, I would say that they are robots - biological robots - something that has no analogy on Earth.

'If Rama is a spaceship, perhaps they are part of its crew. As to how they are born - or created - that's something I can't tell you. But I can guess that the answer's over there in New York. If Commander Norton and his men can wait long enough, they may encounter increasingly more complex creatures, with unpredictable behaviour. Somewhere along the line they may meet the Ramans themselves - the real makers of this world.

'And when that happens, gentlemen, there will be no doubt about it at all...'

CHAPTER THIRTY-FIVE - Special Delivery

Commander Norton was sleeping soundly when his personal communicator dragged him away from happy dreams. He had been holidaying with his family on Mars, flying past the awesome, snow-capped peak of Nix Olympica - mightiest volcano in the solar system. Little Billie had started to say something to him; now he would never know what it was.

The dream faded; the reality was his executive officer, up on the ship.

'Sorry to wake you, Skipper,' said Lieutenant-Commander Kirchoff. 'Triple A priority from Headquarters.'

'Let me have it,' Norton answered sleepily.

'I can't. It's in code - Commander's Eyes Only.'

Norton was instantly awake. He had received such a message only three times in his whole career, and on each occasion it had meant trouble.

'Damn!' he said. 'What do we do now?'

His Exec did not bother to answer. Each understood the problem perfectly; it was one that Ship's Orders had never anticipated. Normally, a commander was never more than a few minutes away from his office and the code book in his personal safe. If he started now, Norton might get back to the ship - exhausted - in four or five hours. That was not the way to handle a Class AAA Priority.

'Jerry,' he said at length. 'Who's on the switchboard?'

'No one; I'm making the call myself.'

'Recorder off?'

'By an odd breach of regulations, yes.

Norton smiled. Jerry was the best Exec he had ever worked with. He thought of everything.

'OK. You know where my key is. Call me back.'

He waited as patiently as he could for the next ten minutes, trying - without much success - to think of other problems. He hated wasting mental effort; it was very unlikely that he could out-guess the message that was coming, and he would know its contents soon enough. Then he would start worrying effectively.

When the Exec called back, he was obviously speaking under considerable strain.

'It's not really urgent Skipper - an hour won't make any difference. But I prefer to avoid radio. I'll send it down by messenger.'

'But why - oh, very well - I trust your judgement. Who will carry it through the airlocks?'

'I'm going myself; I'll call you when I reach the Hub.'

'Which leaves Laura in charge.'

'For one hour, at the most. I'll get right back to the ship.'

A medical officer did not have the specialized training to be acting commander, any more than a commander could be expected to do an operation. In emergencies, both jobs had sometimes been successfully switched; but it was not recommended. Well, one order had already been broken tonight...

'For the record, you never leave the ship. Have you woken Laura?'

'Yes. She's delighted with the opportunity.'

'Lucky that doctors are used to keeping secrets. Oh - have you sent the acknowledgement?'

'Of course, in your name.'

'Then I'll be waiting.'

Now it was quite impossible to avoid anxious anticipations. 'Not really urgent - but I prefer to avoid radio...'

One thing was certain. The Commander was not going to get much more sleep this night.

CHAPTER THIRTY-SIX - Riot Watcher

Sergeant Pieter Rousseau knew why he had volunteered for this job; in many ways, it was a realization of a childhood dream. He had become fascinated by telescopes when he was only six or seven years old, and much of his youth had been spent collecting lenses of all shapes and sizes. These he had mounted in cardboard tubes, making instruments of ever-increasing power until he was familiar with the moon and planets, the nearer space-stations, and the entire landscape within thirty-kilometres of his home.

He had been lucky in his place of birth, among the mountains of Colorado; in almost every direction, the view was spectacular and inexhaustible. He had spent hours exploring, in perfect safety, the peaks which every year took their toll of careless climbers. Though he had seen much, he had imagined even more; he had liked to pretend that over each crest of rock, beyond the reach of his telescope, were magic kingdoms full of wonderful creatures. And so for years he had avoided visiting the places his lenses brought to him, because he knew that. the reality could not live up to the dream.

Now, on the central axis of Rama, he could survey

marvels beyond the wildest fantasies of his youth. A whole world lay spread out before him - a small one, it was true, yet a man could spend an entire lifetime exploring four thousand square kilometres, even when it was dead and changeless.

But now life, with all its infinite possibilities, had come to Rama. If the biological robots were not living creatures, they were certainly very good imitations.

No one knew who invented the word 'biot'; it seemed to come into instant use, by a kind of spontaneous generation. From his vantage point on the Hub, Pieter was Biot-Watcher-in-Chief, and he was beginning, - so he believed - to understand some of their behaviour patterns.

The Spiders were mobile sensors, using vision - and probably touch - to examine the whole interior of Rama. At one time there had been hundreds of them rushing around at high speed, but after less than two days they had disappeared; now it was quite unusual to see even one.

They had been replaced by a whole menagerie of much more impressive creatures; it had been no minor task, thinking of suitable names for them. There were the Window Cleaners, with large padded feet, who were apparently polishing their way the whole length of Rama's - six artificial suns. Their enormous shadows, cast right across the diameter of the world, sometimes caused temporary eclipses on the far side.

The crab that had demolished Dragonfly seemed to be a Scavenger. A relay chain of identical creatures had approached Camp Alpha and carried off all the debris that had been neatly stacked on the outskirts; they would have carried off everything else if Norton and Mercer had not stood firm and defied them. The confrontation had been anxious but brief; thereafter, the Scavengers seemed to understand what they were allowed to touch, and arrived at regular intervals to see if their services were required. It was a most convenient arrangement, and indicated a high degree of intelligence - either on the part of the Scavengers themselves, or some controlling entity elsewhere.

Garbage disposal on Rama was very simple; everything was thrown into the Sea, where it was, presumably, broken down into forms that could be used again. The process was rapid; Resolution had disappeared overnight, to the great annoyance of Ruby Barnes. Norton had consoled her by pointing out that it had done its job magnificently - and he would never have allowed anyone to use it again. The Sharks might not be as discriminating as the Scavengers.

No astronomer discovering an unknown planet could - have been happier that Pieter when he spotted a new type of biot and secured a good photo of it through his telescope. Unfortunately, it seemed that all the interesting species were over at the South Pole, where they were performing mysterious tasks round the Horns. Something that looked like a centipede with suction pads could be seen from time to time exploring Big Horn itself, while round the lower peaks Pieter had caught a glimpse of a burly creature that could have been a cross between a hippopotamus and a bulldozer. And there was even a double-necked giraffe, which apparently acted as a mobile crane.

Presumably, Rama, like any ship, required testing, checking and repairing after its immense voyage. The crew was already hard at work; when would the passengers appear?

Biot classifying was not Pieter's main job; his orders were to keep watch on the two or three exploring parties that were always out, to see that they did not get into trouble, and to warn them if anything approached. He alternated every six hours with anyone else who could be spared, though more than once he had been on duty for twelve hours at a stretch. As a result, he now knew the geography of Rama better than any man who would ever live. It was as familiar to him as the Colorado mountains of his youth.

When Jerry Kirchoff emerged from Airlock Alpha, Pieter knew at once that something unusual was happening. Personnel transfers never occurred during the sleeping period, and it was now past midnight by Mission Time. Then Pieter remembered how short-handed they were, and was shocked by a much more startling irregularity.

'Jerry - who's in charge of the ship?' - 'I am,' said the Exec coldly, as he flipped open his helmet. 'You don't think I'd leave the bridge while I'm on watch, do you?'

He reached into his suit carry-all, and pulled out a small can still bearing the label: CONCENTRATED ORANGE JUICE: TO MAKE FIVE LITRES.

'You're good at this Pieter. The skipper is waiting for it.' Pieter hefted the can, then said, 'I hope you've put enough mass inside it - sometimes they get stuck on the first terrace.'

'Well, you're the expert.'

That was true enough. The Hub observers had had plenty of practice, sending down small items that had been forgotten or were needed in a hurry. The trick was

to get them safely past the low-gravity region,. and then to see that the Coriolis effect did not carry them too far away from the Camp during the eight-kilometre roll downhill.

Pieter anchored himself firmly, grasped the can, and hurled it down the face of the cliff. He did not aim directly towards Camp Alpha, but almost thirty degrees away from it.

Almost immediately, air resistance robbed the can of its initial speed, but then the pseudo-gravity of Rama took over and it started to move downwards at a constant velocity. It hit once near the base of the ladder, and did a slow-motion bounce which took it clear of the first terrace.

'It's OK now,' said Pieter. 'Like to make a bet?'

'No,' was the prompt reply. 'You know the odds.'

'You're no sportsman. But I'll tell you now - it will stop within three hundred metres of the Camp.'

'That doesn't sound very close.'

'You might try it some time. I once saw Joe miss by a couple of kilometres.'

The can was no longer bouncing; gravity had become strong enough to glue it to the curving face of the North Dome. By the time it had reached the second terrace it was rolling along at twenty or thirty kilometres an hour, and had reached very nearly the maximum speed that friction would allow.

'Now we'll have to wait,' said Pieter, seating himself at the telescope, so that he could keep track of the messenger. 'It will be there in ten minutes. Ah, here comes the skipper - I've got used to recognizing people from this angle - now he's looking up at us.

'I believe that telescope gives you a sense of power.'

'Oh, it does. I'm the only person who knows everything that's happening in Rama. At least, I thought I did,' he added plaintively, giving Kirchoff a reproachful look.

'If it will keep you happy, the skipper found he'd run out of toothpaste.'

After that, conversation languished; but at last Pieter said: 'Wish you'd taken that bet ... he's only got to walk fifty metres ... now he sees it ... mission complete.'

'Thanks, Pieter - a very good job. Now you can go back to sleep.'

'Sleep! I'm on watch until 0400.'

'Sorry - you must have been sleeping. Or how else could you have dreamed all this?'

SPACE SURVEY HQ TO COMMANDER SSV ENDEAVOUR. PRIORITY AAA. CI.ASSIFICATION YOUR EYES ONLY. NO PERMANENT RECORD.
SPACEGUARD REPORTS ULTRA HIGH SPEED VEHICLE APPARENTLY LAUNCHED MERCURY TEN TO TWELVE DAYS AGO ON RAMA INTERCEPT. IF NO ORBIT CHANGE ARRIVAL PREDICTED DATE 322 DAYS 15 HOURS. MAY BE NECESSARY YOU EVACUATE BEFORE THEN. WILL ADVISE FURTHER.

C IN C

Norton read the message half a dozen times to memorize the date. It was hard to keep track of time inside Rama; he had to look at his calendar watch to see that it was now Day 315. That might leave them only one week...

The message was chilling, not only for what it said, but for what it implied. The Hermians had made a clandestine launch - that in itself a breach of Space Law. The conclusion was obvious; their 'vehicle' could only be a missile.

But why? It was inconceivable - well, almost inconceivable - that they would risk endangering Endeavour, so presumably he would receive ample warning from the Hermians themselves. In an emergency, he could leave at a few hours' notice, though he would do so only under extreme protest, at the direct orders of the Commander-in-Chief.

Slowly, and very thoughtfully, he walked across to the improvised life-support complex and dropped the message into an electrosan. The brilliant flare of laser light bursting out through the crack beneath the seat-cover told him that the demands of security were satisfied. It was too bad, he told himself, that all problems could not be disposed of so swiftly and hygienically.

CHAPTER THIRTY-SEVEN - Missile

The missile was still five million kilometres away when the glare of its plasma braking jets became clearly visible in Endeavour's main telescope. By that time the secret was already out, and Norton had reluctantly ordered the second and perhaps final evacuation of Rama; but he had no intention of leaving until events gave him no alternative.

When it had completed its braking manoeuvre, the unwelcome guest from Mercury was only fifty kilometres

from Rama, and apparently carrying out a survey through its TV cameras. These were clearly visible - one fore and One aft - as were several small omni-antennas and one large directional dish, aimed steadily at the distant star of Mercury. Norton wondered what instructions were coming down that beam, and what information was going back.

Yet the Hermians could learn nothing that they did not already know; all that Endeavour had discovered had been broadcast throughout the solar system. This spacecraft - which had broken all speed records to get here - could only be an extension of its makers' will, an instrument of their purpose. That purpose would soon be known, for in three hours the Hermian Ambassador to the United Planets would be addressing the General Assembly.

Officially, the missile did not yet exist. It bore no identification marks, and was not radiating on any standard beacon frequency. This was a serious breach of law, but even SPACEGUARD had not yet issued a formal protest. Everyone was waiting, with nervous impatience, to see what Mercury would do next.

It had been three days since the missile's existence - and origin - had been announced; all that time, the Hermians had remained stubbornly silent. They ,could be very good at that, when it suited them.

Some psychologists had claimed that it was almost impossible to understand fully the mentality of anyone born and bred on Mercury. Forever exiled from Earth by its three-times-more-powerful gravity, Hermians could stand on the Moon and look across the narrow gap to the planet of their ancestors - even of their own parents - but they could never visit it. And so, inevitably, they claimed that they did not want to.

The pretended to despise the soft rains, the rolling fields, the lakes and seas, the blue skies - all the things that they could know only through recordings. Because their planet was drenched with such solar energy that the day time temperature often reached six hundred degrees, they affected a rather swaggering roughness that did not bear a moment's serious examination. In fact, they tended to be physically weak, since they could only survive if they were totally insulated from their environment. Even if he could have tolerated the gravity, a Hermian would have been quickly incapacitated by a hot day in any equatorial country on Earth.

Yet in matters that really counted, they were tough. The psychological pressures of that ravening star so close at hand, the engineering problems of tearing into a stubborn planet and wrenching from it all the necessities of life - these had produced a spartan and in many ways

highly admirable culture. You could rely on the Hermians; if they promised something, they would do it - though the bill might be considerable. It was their own joke that, if the sun ever showed signs of going nova, they would contract to get it under control - once the fee had been settled. It was a non-Hermian joke that any child who showed signs of interest in art, philosophy or abstract mathematics was ploughed straight back into the hydroponic farms. As far as criminals and psychopaths were concerned, this was not a joke at all. Crime was one of the luxuries that Mercury could not afford.

Commander Norton had been to Mercury once, had been enormously impressed - like most visitors - and had acquired many Hermian friends. He had fallen in love with a girl in Port Lucifer, and had even contemplated signing a three-year contract, but parental disapproval of anyone from outside the orbit of Venus had been too strong. It was just as well.

'Triple A message from Earth, Skipper,' said the bridge. 'V9ice and back-up text from Commander-in-Chief. Ready to accept?'

'Check and file text; let me have the voice.

'Here it comes.'

Admiral Hendrix sounded calm and matter-of-fact, as if he was issuing a routine fleet order, instead of handling a situation unique in the history of space. But then, he was not ten kilometres from the bomb.

'C-in-C to Commander, Endeavour. This is a quick summary of the situation as we see it now. You know that the General Assembly meets at i4.oo and you'll be listening to the proceedings. It is possible that you may then have to take action immediately, without consultation; hence this briefing.

'We've analysed the photos you have sent us; the vehicle is a standard space-probe, modified for high-impulse and probably laser-riding for initial boost. Size and mass are consistent with fusion bomb in the 500 to 1,ooo megaton range; the Hermians use up to 1oo megatons routinely in their mining operations, so they would have had no difficulty in assembling such a warhead.

'Our experts also estimate that this would be the minimum size necessary to assure destruction of Rama. If it was detonated against the thinnest part of the shell - underneath the Cylindrical Sea - the hull would be ruptured and the spin of the body would complete its disintegration.

'We assume that the Hermians, if they are planning such an act, will give you ample time to get clear. For

your information, the gamma-ray flash from such a bomb could be dangerous to you up to a range of a thousand kilometres.

'But that is not the most serious danger. The fragments of Rama, weighing tons and spinning off at almost a thousand kilometres an hour, could destroy you at an unlimited distance. We therefore recommend that you proceed along the spin axis, since no fragments will be thrown off in that direction. Ten thousand kilometres should give an adequate safety margin.

'This message cannot be intercepted; it is going by multiple-pseudo-random routing, so I can talk in clear English. Your reply may not be secure, so speak with discretion and use code when necessary. I will call you immediately after the General Assembly discussion. Message concluded. C-in-C, out.'

CHAPTER THIRTY-EIGHT - General Assembly

According to the history books - though no one could really believe it - there had been a time when the old United Nations had '72 members. The United planets had only seven; and that was sometimes bad enough. In order of distance from the Sun, they were Mercury, Earth, Luna, Mars, Ganymede, Titan and Triton.

The list contained numerous omissions and ambiguities which presumably the future would rectify. Critics never tired of pointing out that most of the United Planets were not planets at all, but satellites. And how ridiculous that the four giants, Jupiter, Saturn, Uranus and Neptune were not included ...

But no one lived on the Gas Giants, and quite possibly no one ever would. The same might be true of the other major absentee, Venus. Even the most enthusiastic of planetary engineers agreed that it would take centuries to tame Venus; meanwhile the Hermians kept their eyes on her, and doubtless brooded over long-range plans.

Separate representation for Earth and Luna had also been a bone of contention; the other members argued that it put too much power in one corner of the solar system. But there were more people on the Moon than all the other worlds except Earth itself - and it was the meeting place of the UP. Moreover, Earth and Moon hardly ever agreed on anything, so they were not likely to constitute a dangerous bloc.

Mars held the asteroids in trust - except for the Icarian group (supervised by Mercury) and a handful with perihelions beyond Saturn - and thus claimed by Titan. One day the larger asteroids, such as Pallas, Vesta, Juno and Ceres, would be important enough to have their own ambassadors, and membership of the UP would then reach

two figures.

Ganymede represented not only Jupiter - and therefore more mass than all the rest of the solar system put together - but also the remaining fifty or so Jovian satellites, if one included temporary captures from the asteroid belt (the lawyers were still arguing over this). In the same way, Titan took care of Saturn, its rings and the other thirty-plus satellites.

The situation for Triton was even more complicated. The large moon of Neptune was the outermost body in the solar system under permanent habitation; as a result, its ambassador wore a considerable number of hats. He represented Uranus and its eight moons (none yet occupied); Neptune and its other three satellites; Pluto and its solitary moon; and lonely, moonless Persephone. If there were planets beyond Persephone, they too would be Triton's responsibility. And as if that was not enough, the Ambassador for the Outer Darkness, as he was sometimes called, had been heard to ask plaintively: 'What about comets?' It was generally felt that this problem could be left for the future to solve.

And yet, in a very real sense, that future was already here. By some definitions, Rama was a comet; they were the only other visitors from the interstellar deeps, and many had travelled on hyperbolic orbits even closer to the Sun than Rama's. Any space-lawyer could make a very good case out of that - and the Hermian Ambassador was one of the best.

'We recognize His Excellency the Ambassador for Mercury.'

As the delegates were arranged counter-clockwise in order of distance from the sun, the Hermian was on the President's extreme right. Up to the very last minute, he had been interfacing with his computer; now he removed the synchronizing spectacles which allowed, no one else to read the message on the display screen. He picked up his sheaf of notes, and rose briskly to his feet.

'Mr President, distinguished fellow delegates, I would like to begin with a brief summary of the situation which now confronts us.'

From some delegates, that phrase 'a brief summary' would have evoked silent groans among all listeners; but everyone knew that Hermians meant exactly what they said.

'The giant spaceship, or artificial asteroid, which has been christened Rama was detected over a year ago, in the region beyond Jupiter. At first it was believed to be a natural body, moving on a hyperbolic orbit which would take it round the sun and on to the stars.

'When its true nature was discovered, the Solar Survey Vessel Endeavour was ordered to rendezvous with it. I am sure we will all congratulate Commander Norton and his crew for the efficient way in which they have carried out their unique assignment.

'At first, it was believed that Rama was dead - frozen for so many hundreds of thousands of years that there was no possibility of revival. This may still be true, in a strictly biological sense. There seems general agreement, among those who have studied the matter, that no living organism of any complexity can survive more than a very few centuries of suspended animation. Even at absolute zero, residual quantum effects eventually erase too much cellular information to make revival possible. It therefore appeared that, although Rama was of enormous archaeological importance, it did not present any major astropolitical problems.

'It is now obvious that this was a very naïve attitude, though even from the first there were some who pointed out that Rama was too precisely aimed at the Sun for pure chance to be involved.

'Even so, it might have been argued -. indeed, it was argued - that here was an experiment that had failed. Rama had reached the intended target, but the controlling intelligence had not survived. This view also seems very simple-minded; it surely underestimates the entities we are dealing with.

'What we failed to take into account was the possibility of non-biological survival. If we accept Dr Perera's very plausible theory, which certainly fits all the facts, the creatures who have been observed inside Rama did not exist until a short time ago. Their patterns, or templates, were stored in some central information bank, and when the time was ripe they were manufactured from available raw materials - presumably the metallo-organic soup of the Cylindrical Sea. Such a feat is still somewhat beyond our own ability, but does not present any theoretical problems. We know that solid state circuits, unlike living matter, can store information without loss, for indefinite periods of time.

'So Rama is now in full operating condition, serving the purpose of its builders - whoever they may be. From our point of view, it does not matter if the Ramans themselves have all been dead for a million years, or whether they too will be re-created, to join their servants, at any moment. With or Without them, their will is being done and will continue to be done.

'Rama has now given proof that its propulsion system is still operating. In a few days, it will be at perihelion, where it would logically make any major orbit change.

We may therefore soon have a new planet - moving through the solar space over which my government has jurisdiction. Or it may. of course, make additional changes and occupy a final orbit at any distance from the sun. It could even become a satellite of a major planet - such as Earth ...

'We are therefore, fellow delegates, faced with a whole spectrum of possibilities, some of them very serious indeed. It is foolish to pretend that these creatures must be benevolent and will not interfere with us in any way. If they come to our solar system, they need something from it. Even if it is only scientific knowledge - consider how that knowledge may be used

'What confronts us now is a technology hundreds - perhaps thousands - of years in advance of ours, and a culture which may have no points of contact whatsoever. We have been studying the behaviour of the biological robots - the biots - inside Rama, as shown on the films that Commander Norton has relayed, and we have arrived at certain conclusions which we wish to pass on to you.

'On Mercury we are perhaps unlucky in having no indigenous life-forms to observe. But, of course, we have a complete record of terrestrial zoology, and we find in it one striking parallel with Rama.

'This is the termite colony. Like Rama, it is an artificial world with a controlled environment. Like Rama, its functioning depends upon a whole series of specialized biological machines - workers, builders, farmers - warriors. And although we do not know if Rama has a queen, I suggest that the island known as New York serves a similar function.

'Now, it would obviously be absurd to press this analogy too far; it breaks down at many points. But I put it to you for this reason.

'What degree of cooperation or understanding would ever be possible between human beings and termites? When there is no conflict of interest, we tolerate each other. But when either needs the other's territory or resources, no quarter is given.

'Thanks to our technology and our intelligence, we can always win, if we are sufficiently determined. But sometimes it is not easy, and there are those who believe that, in the long run, final victory may yet go to the termites...

'With this in mind, consider now the appalling threat that Rama may - I do not say must present to human civilization. What steps have we taken to counter it, if the worst eventuality should occur? None whatsoever; we have merely talked and speculated and written learned

papers.

'Well, my fellow delegates, Mercury has done more than this. Acting under the provisions of Clause 34 of the Space Treaty of 2057, which entitled us to take any steps necessary to protect the integrity of our solar space, we have dispatched a high-energy nuclear device to Rama. We will indeed be happy if we never have to utilize it. But now, at least, we are not helpless - as we were before.

'It may be argued that we have acted unilaterally, without prior consultation. We admit that. But does anyone here imagine - with, all respect, Mister President - that we could have secured any such agreement in the time available? We consider that we are acting not only for ourselves, but for the whole human race. All future generations may one day thank us for our foresight.

'We recognized that it would be a tragedy - even a crime - to destroy an artifact as wonderful as Rama. If there is any way in which this can be avoided, without risk to humanity, we will be very happy to hear of it. We have not found one, and time is running out.

'Within the next few days, before Rama reaches perihelion, the choke will have to be made. We will, of course, give ample warning to Endeavour - but we would advise Commander Norton always to be ready to leave at an hour's notice. It is conceivable that Rama may undergo further dramatic transformations at any moment.

'That is all, Mister President, fellow delegates. I thank you for your attention. I look forward to your cooperation.'

CHAPTER THIRTY-NINE - Command Decision

'Well, Rod, how do the Hermians fit into your theology?'

'Only too well, Commander,' replied Rodrigo with a humourless smile. 'It's the age-old conflict between the forces of good and the forces of evil. And there are times when men have to take sides in such a conflict.'

I thought it would be something like that, Norton told himself. This situation must have been a shock to Boris, but he would not have resigned himself to passive acquiescence. The Cosmo-Christers were very energetic, competent people. Indeed, in some ways they were remarkably like the Hermians.

'I take it you have a plan, Rod.'

'Yes, Commander. It's really quite simple. We merely have to disable the bomb.'

'Oh. And how do you propose to do that?'

'With a small pair of wire-cutters.'

If this had been anyone else, Norton would have assumed that they were joking. But not Boris Rodrigo.

'Now just a minute! It's bristling with cameras. Do you suppose the Hermians will just sit and watch you?'

'Of course; that's all they can do. When the signal reaches them, it will be far too late. I can easily finish the job in ten minutes.

'I see. They certainly will be mad. But suppose the bomb is booby-trapped so that interference sets it off?'

'That seems very unlikely; what would be the purpose? This bomb was built for a specific deep-space mission, and it will be fitted with all sorts of safety devices to prevent detonation except on a positive command. But that's a risk I'm prepared to take - and it can be done without endangering the ship. I've worked everything out.'

'I'm sure you have,' said Norton. The idea was fascinating - almost seductive in its appeal; he particularly liked the idea of the frustrated Hermians; and would give a good deal to see their reactions when they realized - too late - what was happening to their deadly toy.

But there were other complications, and they seemed to multiply as Norton surveyed the problem. He was facing by far the most difficult, and the most crucial, decision in his entire career.

And that was a ridiculous understatement. He was faced with the most difficult decision any commander had ever had to make; the future of the entire human race might well depend upon It. For just suppose the Hermians were right?
When Rodrigo had left, he switched on the DO NOT DISTURB sign; he could not remember when he had last used it, and was mildly surprised that it was working. Now, in the heart of his crowded, busy ship, he was completely alone - except for the portrait of Captain James Cook, gazing at him down the corridors of time.

It was impossible to consult with Earth; he had already been warned that any messages might be tapped - perhaps by relay devices on the bomb itself. That left the whole responsibility in his hands.

There was a story he had heard somewhere about a President of the United States - was it Roosevelt or Perez? - who had a sign on his desk saying 'The buck stops here'. Norton was not quite certain what a buck was, but he knew when one had stopped at his desk.

He could do nothing, and wait until the Hermians advised him to leave. How would that look in the histories of the future? Norton was not greatly concerned with posthumous fame or infamy, yet he would not care to be remembered for ever as the accessory to a cosmic crime - which it had been in his power to prevent.

And the plan was flawless. As he had expected, Rodrigo had worked out every detail, anticipated every possibility even the remote danger that the bomb might be triggered when tampered with. If that happened, Endeavour could still be safe, behind the shield of Rama. As for Lieutenant Rodrigo himself, he seemed to regard the possibility of instant apotheosis with complete equanimity.

Yet, even if the bomb was successfully disabled, that would be far from the end of the matter. The Hermians might try again - unless some way could be found of stopping them. But at least weeks of time would have been bought; Rama would be far past perihelion before another missile could possibly reach it. By then, hopefully, the worst fears of the alarmists might have been disproved. Or the reverse...

To act, or not to act - that was the question. Never before had Commander Norton felt such a close kinship with the Prince of Denmark. Whatever he did, the possibilities for good and evil seemed in perfect balance. He was faced with the most morally difficult of all decisions. If his choice was wrong, he would know very quickly. But if he was correct - he might never be able to prove it...

It was no use relying any further on logical arguments and the endless mapping of alternative futures. That way, one could go round and round in circles for ever. The time had come to listen to his inner voices.

He returned the calm, steady gaze across the centuries. 'I agree with you, Captain,' he whispered. 'The human race has to live with its conscience. Whatever the Hermians argue, survival is not everything.'

He pressed the call button for the bridge circuit and said slowly, 'Lieutenant Rodrigo - I'd like to see you.

Then he closed his eyes, hooked his thumbs in the restraining straps of his chair, and prepared to enjoy a few moments of total relaxation.

It might be some time before he would experience it again.

CHAPTER FORTY - Saboteur

The scooter had been stripped of all unnecessary equipment; it was now merely an open framework holding together propulsion, guidance and life-support systems.

Even the seat for the second pilot had been removed, for every kilogramme of extra mass had to be paid for in mission time.

That was one of the reasons, though not the most important, why Rodrigo had insisted on going along. It was such a simple job that there was no need for any extra hands, and the mass of a passenger would cost several minutes of flight time. Now the stripped-down scooter could accelerate at over a third of a gravity; it could make the trip from Endeavour to the bomb in four minutes. That left six to spare; it should. be sufficient.

Rodrigo looked back only once when he had left the ship; he saw that, as planned, it had lifted from the central axis and was thrusting gently away across the spinning disc of the North Face. By the time he reached the bomb, it would have placed the thickness of Rama between them.

He took his time, flying over the polar plain. There was no hurry here, because the bomb's cameras could not yet see him, and he could therefore conserve fuel. Then he drifted over the curving rim of the world - and there was the missile, glittering in sunlight fiercer even than that shining cm the planet of its birth.

Rodrigo had already punched in the guidance instructions. He initiated the sequence; the scooter spun on its gyros, and came up to full thrust in a matter of seconds. At first the sensation of weight seemed crushing; then ~ Rodrigo adjusted to it. He had, after all, comfortably endured twice as much inside Rama - and had been born under three times as much on Earth.

The huge, curving exterior wall of the fifty-kilometre cylinder was slowly falling away beneath him as the scooter aimed itself directly at the bomb. Yet it was impossible to judge Rama's size, since it was completely smooth and featureless - so featureless, indeed, that it was difficult to tell that it was spinning.

One hundred seconds into the mission; he was approaching the halfway point. The bomb was still too far away to show any details, but it was much brighter against the let-black sky. It was strange to see no stars - not even brilliant Earth or dazzling Venus; the dark filters which protected his eyes against the deadly glare made that impossible. Rodrigo guessed that he was breaking a record; probably no other man had ever engaged in extra-vehicular work so close to the sun. It was lucky for him that solar activity was low.

At two minutes ten seconds the flip-over light started flashing, thrust dropped to zero, and the scooter spun through 180 degrees. -Full thrust was back in an instant,

but now he was decelerating at the same mad rate Of three metres per second squared - rather better than that, in fact, since he had lost almost half his propellent mass. The bomb was twenty-five kilometres away; he would be there in another two minutes. He had hit a top speed of fifteen hundred kilometres an hour - which, for a space-scooter, was utter insanity, and probably another record. But this was hardly a routine EVA, and he knew precisely what he was doing.

The bomb was growing; and now he could see the main antenna, holding steady on the invisible star of Mercury. Along that beam, the image of his approaching scooter had been flashing at the speed of- light for the last three minutes. There were still two to go, before it reached Mercury.

What would the Hermians do, when they saw him? There would be consternation, of course; they would realize instantly that he had made a rendezvous with the bomb several minutes before they 'even knew he was on the way. Probably some stand-by observer would call higher authority - that would take more time. But even in the worst possible case - even if the officer on duty had authority to detonate the bomb, and pressed the button immediately - it would take another five minutes for the signal to arrive.

Though Rodrigo was not gambling on it - Cosmo-Christers never gambled - he was quite sure that there would be no such instantaneous reaction. The Hermians would hesitate to destroy a reconnaissance vehicle from Endeavour, even if they suspected its motives. They would certainly attempt some form of communication first - and that would mean more delay.

And there was an even better reason; they would not waste a gigaton bomb on. a mere scooter. Wasted it would be, if it was detonated twenty kilometres from its target. They would have to move it first. Oh, he had plenty of time. . . but he would still assume the very worst.

He would act as if the triggering impulse would arrive in the shortest possible time - just five minutes.

As the scooter closed in across the last few hundred metres, Rodrigo quickly matched the details he could now see with those he had studied in the photographs taken at long range. What had been only a collection of pictures became hard metal and smooth plastic - no longer abstract, but a deadly reality.

The bomb was a cylinder about ten metres long and three in diameter - by a strange coincidence, almost the same proportions as Rama itself. It was attached to the framework of the carrier vehicle by an open lattice-work of short I-beams. For some reason, probably to do with the

location of the centre of mass, it was supported at right angles to the axis of the carrier, so that it conveyed an appropriately sinister hammer-head impression. It was indeed a hammer, one powerful enough to smash a world.

From each end of the bomb, a bundle of braided cables ran along the cylindrical side and disappeared through the lattice-work into the interior of the vehicle. All communication and control was here; there was no antenna of any kind on the bomb itself. Rodrigo had only to cut those two sets of cables and there would be nothing here but harmless, inert metal.

Although this was exactly what he had expected, it still seemed a little too easy. He glanced at his watch; it would be another thirty seconds before the Hermians, even if they had been watching when he rounded the edge of Rama, could know of his existence. He had an absolutely certain five minutes for uninterrupted work - and a ninety-nine per cent probability of much longer than that. -

As soon as the scooter had drifted to a complete halt, Rodrigo grappled it to the missile framework so that the two formed a rigid structure. That took only seconds; he had already chosen his tools, and was out of the pilot's seat at once, only slightly hampered by the stiffness of his heavy-insulation suit.

The first thing he found himself inspecting was a small metal plate bearing the inscription:

DEPARTMENT OF POWER ENGINEERING

Section D,

47, Sunset Boulevard,

Vulcanopolis, 17464

For information apply to Mr Henry K. Jones

Rodrigo suspected that, in a very few minutes, Mr Jones might be rather busy.

The heavy wire-cutters made short work of the cable. As the fist strands parted, Rodrigo gave scarcely a thought to the fires of hell that were pent up only centimetres away; if his actions triggered them, he would never know.

He glanced again at his watch; this had taken less than a minute, which meant that he was on schedule. Now for the back-up cable - and then he could head for home, in full view of the furious and frustrated Hermians.,

He was just beginning to work on the second cable

assembly when he felt a faint vibration in the metal he was touching. Startled, he looked back along the body of the missile.

The characteristic blue-violet glow of a plasma thruster in action was hovering round one of the attitude control jets. The bomb was preparing to move.

The message from Mercury was brief, and devastating. It arrived two minutes after Rodrigo had disappeared around the edge of Rama.

COMMANDER ENDEAVOUR FROM MERCURY SPACE CONTROL,

INFERNO WEST. YOU HAVE ONE HOUR FROM RECEIPT OF

THIS MESSAGE TO LEAVE VICINITY OF RAMA. SUGGEST YOU

PROCEED MAXIMUM ACCELERATION ALONG SPIN AXIS. RE-

QUEST ACKNOWLEDGEMENT. MESSAGE ENDS.

Norton read it with sheer disbelief, then anger. He felt a childish impulse to radio back that all his crew were inside Rama, and it would take hours to get everyone out. But that would achieve nothing - except perhaps to test the will and nerve of the Hermians.

And why, several days before perihelion, had they decided to act? He wondered if the mounting pressure of public opinion was becoming too great, and they decided to present the rest of the human race with a fait accompli. It seemed an unlikely explanation; such sensitivity would have been uncharacteristic.

There was no way in which he could recall Rodrigo, for the scooter was now in the radio shadow of Rama and would be out of contact until they were in line of sight again. That would not be until the mission was completed - or had failed.

He would have to wait it out; there was still plenty of time - a full fifty minutes. Meanwhile, he had decided on the most effective answer to Mercury.

He would ignore the message completely, and see what the Hermians did next.

Rodrigo's first sensation, when the bomb started to move, was not one of physical fear; it was something much more devastating. He believed that the universe operated according to strict laws, which not even God Himself could disobey - much less the Hermians. No message could travel faster than light; he was five minutes ahead of anything that Mercury could do.

This could only be a coincidence - fantastic, and perhaps deadly, but no more than that. By chance, a control signal must have been sent to the bomb at about the time

he was leaving Endeavour; while he was travelling fifty kilometres, it had covered eighty million.

Or perhaps this was only an automatic change of attitude, to counter over-heating somewhere in the vehicle. There were places where the skin temperature approached fifteen hundred degrees, and Rodrigo had been very careful to keep in the shadows as far as possible.

A second thruster started to fire, checking the spin given by the first. No, this was not a mere thermal adjustment. The bomb was re-orientating itself, to point to-. wards .....

Useless to wonder why this was happening at this precise moment in time. There was one thing in his favour; the missile was a low acceleration device. A tenth of a gee was the most that it could manage. He could hang on.

He checked the grapples attaching the scooter to the bomb framework, and re-checked the safety line on his own suit. A cold anger was growing in his mind, adding to his determination. Did this manoeuvre mean that the Hermians were going to explode the bomb without warning, giving Endeavour no chance to escape? That seemed incredible - an act not only of brutality but of folly, calculated to turn the rest of the solar system against them. And what would have made them ignore the solemn promise of their own Ambassador?

Whatever their plan, they would not get away with it.

The second message from Mercury was identical with the first, and arrived ten minutes later. So they had extended the deadline - Norton still had one hour. And they had obviously waited until a reply from Endeavour could have reached them before calling him again.

Now there was another factor; by this time they must have seen Rodrigo, and would have had several minutes in which to take action. Their instructions could already be on the way. They could arrive at any second.

He should be preparing to leave. At any moment, the sky-filling bulk of Rama might become incandescent along the edges, blazing with a transient glory that would far outshine the sun.

When the main thrust came on, Rodrigo was securely anchored. Only twenty seconds later, it cut off again. He did a quick mental calculation; the delta vee could not have been more than fifteen kilometres an hour. The bomb would take over an hour to reach Rama; perhaps it was only moving in close to get a quicker reaction. If so, that was a wise precaution; but the Hermians had left it too late.

Rodrigo glanced at his watch, though by now he was almost aware of the time without having to check. On Mercury, they would now be seeing him heading purposefully towards the bomb, and less than two kilometres away from it. They could have no doubt of his intentions, and would be wondering if he had already carried them out.

The second set of cables went as easily as the first; like any good workman, Rodrigo had chosen his tools well. The bomb was disarmed; or, to be more accurate, it could no longer be detonated by remote command.

Yet there was one other possibility, and he could not afford to ignore it. There were no external contact fuses, but there might be internal ones, armed by the shock of impact. The Hermians still had control over their vehicle's movements, and could crash it into Rama whenever they wished. Rodrigo's work was not yet completely finished.

Five minutes from now, in that control room somewhere on Mercury, they would see him crawling back along the exterior of the missile, carrying the modestly-sized wire-cutters that had neutralized the mightiest weapon ever built by man. He was almost tempted to wave at the camera, but decided that it would seem undignified; after all, he was making history, and millions would watch this scene in the years to come. Unless, of course, the Hermians destroyed the recording in a fit of pique; he would hardly blame them.

He reached the mounting of the long-range antenna, and drifted hand-over-hand along it to the big dish. His faithful cutters made short work of the multiplex feed system, chewing up cables and laser wave guides alike. When he made the last snip, the antenna started to swing slowly around; the unexpected movement took him by surprise, until he realized that he had destroyed its automatic lock on Mercury. Just five minutes from now, the Hermians would lose all contact with their servant. Not only was it impotent; now it was blind and deaf.

Rodrigo climbed slowly back to the scooter, released the shackles, and swung it round until the forward bumpers were pressing against the missile, as close as possible to its centre of mass. He brought thrust up to full power, and held it there for twenty seconds.

Pushing against many times its own mass, the scooter responded very sluggishly. When Rodrigo cut the thrust back to zero, he took a careful reading of the bomb's new velocity vector.

It would miss Rama by a wide margin - and it could be located again with precision at any future time. It was,

after all, a very valuable piece of equipment.

Lieutenant Rodrigo was a man of almost pathological honesty. He would not like the Hermians to accuse him of losing their property.

CHAPTER FORTY-ONE - Hero

'Darling,' began Norton, 'this nonsense has cost us more than a day, but at least it's given me a chance to talk to you.

'I'm still in the ship, and she's heading back to station at the polar axis. We picked up Rod an hour ago, looking as if he'd just come off duty after a quiet watch. I suppose neither of us will ever be able to visit Mercury again, and I'm wondering if we're going to be treated as heroes or villains when we get back to Earth. But my conscience is clear; I'm sure we did the right thing. I wonder if the Ramans will ever say "thank you".

'We can stay here only two more days; unlike Rama, we don't have a kilometre-thick skin to protect us from the sun. The hull's already developing dangerous hot-spots and we've had to put out some local screening. I'm sorry - I didn't want to bore you with my problems...

'So there's time for just one more trip into Rama, and I intend to make the most of it. But don't worry - I'm not taking any chances.'

He stopped the recording. That, to say the least, was stretching the truth. There was danger and uncertainty about every moment inside Rama; no man could ever feel really at home there, in the presence of forces beyond his understanding. And on this final trip, now that he knew they would never return and that no future operations would be jeopardized, he intended to press his luck just a little further.

'In forty-eight hours, then, we'll have completed this mission. What happens then is still uncertain; as you know, we've used virtually all our fuel getting into this orbit. I'm still waiting to hear if a tanker can rendezvous with us in time to get back to Earth, or whether we'll have to make planet-fall at Mars. Anyway, I should be home by Christmas. Tell Junior I'm sorry I can't bring a baby biot; there's no such animal...

'We're all fine, but we're very tired. I've earned a long leave after all this, and we'll make up for lost time. Whatever they say about me, you can claim you're married to a hero. How many wives have a husband who saved a world?'

As always, he listened carefully to the tape before duping it, to make sure that it was applicable to both his

families. It was strange to think that he did not know which of them he would see first; usually, his schedule was determined at least a year in advance, by the inexorable movements of the planets themselves.

But that was in the days before Rama; now nothing would ever be the same again.

CHAPTER FORTY-TWO - Temple of Glass

'If we try it,' said Karl Mercer, 'do you think the bio will stop us?'

'They may; that's one of the things I want to find out Why are you looking at me like that?'

Mercer gave his slow, secret grin, which was liable to be set off at any moment by a private joke he might or might not share with his shipmates.

'I was wondering, Skipper, if you think you own Rama. Until now, you've vetoed any attempt to cut into buildings. Why the switch? Have the Hermians given you ideas?'

Norton laughed, then suddenly checked himself. It was a shrewd question, and he was not sure if the obvious answers were the right ones.

'Perhaps I have been ultra-cautious - I've tried to avoid trouble. But this is our last chance; if we're forced to retreat we won't have lost much.'

'Assuming that we retreat in good order.'

'Of course. But the biots have never shown hostility; and except for the Spiders, I don't believe there's anything here that can catch us - if we do have to run for it.'

'You may run, Skipper, but I intend to leave with dignity. And incidentally, I've decided why the biots are so polite to us.'

'It's a little late for a new theory.'

'Here it is, anyway. They think we're Ramans. They can't tell the difference between one oxy-eater and another.'

'I don't believe they're that stupid.'

'It's not a matter of stupidity. They've beep programmed for their particular jobs, and we simply don't come into their frame of reference.'

'Perhaps you're right. We may find out - as soon as we

start to work on London.'

Joe Calvert had always enjoyed those old bank-robbery movies, but he had never expected to be involved in one. Yet this was, essentially, what he was doing now.

The. deserted streets of 'London' seemed full of menace, though he knew that was only his guilty conscience. He did not really believe that the sealed and windowless structures ranged all around them were full of watchful inhabitants, waiting to emerge in angry hordes as soon as the invaders laid a hand on their property. In fact, he was quite certain that this whole complex - like all the other towns - was merely some kind of storage area.

Yet a second fear, also based on innumerable ancient crime dramas, could be better grounded. There might be no clanging alarm bells and screaming sirens, but it was reasonable to assume that Rama would have some kind of warning system. How otherwise did the biots know when and where their services were needed?

'Those without goggles, turn your backs,' ordered Sergeant Myron. There was a smell of nitric oxides as the air itself started to burn in the beam of the laser torch, and a steady sizzling as the fiery knife sliced towards secrets that had been hidden since the birth of man.

Nothing material could resist this concentration of power, and the cut proceeded smoothly at a rate of several metres a minute. In a remarkably short time, a section large enough to admit a man had been sliced out.

As the cut-away section showed no signs of moving, Myron tapped it gently - then harder - then banged on it with all his strength. It fell inwards with a hollow, reverberating crash.

Once again, as he had done during that very first entrance into Rama, Norton remembered the archaeologist who had opened the old Egyptian tomb. He did not expect to see the glitter of gold; in fact, he had no preconceived ideas at all, as he crawled through the opening, his flashlight held in front of him.

A Greek temple made of glass - that was his first impression. The building was filled with row upon row of vertical crystalline columns, about a metre wide and stretching from floor to ceiling. There were hundreds of them, marching away into the darkness beyond the reach of his light.

Norton walked towards the nearest column and directed his beam into its interior. Refracted as through a cylindrical lens, the light fanned out on the far side to be focused and refocused, getting fainter with each repeti-

tion, in the array of pillars beyond. He felt that he was in the middle of some complicated demonstration in optics.

'Very pretty,' said the practical Mercer, 'but what does it mean? Who needs a forest of glass pillars?'

Norton rapped gently on one column. It sounded solid, though more metallic than crystalline. He was completely baffled, and so followed a piece of useful advice he had heard long ago: 'When in doubt, say nothing and move on.

As he reached the next column, which looked exactly like the first, he heard an exclamation of surprise from Mercer.

'I could have sworn this pillar was empty - now there's something inside it.'

Norton glanced quickly back.

'Where?' he said. 'I don't see anything.'

He followed the direction of Mercer's pointing finger. It was aimed at nothing; the column was still completely transparent.

'You can't see it?' said Mercer incredulously. 'Come around this side. Damn - now I've lost it!'

'What's going on here?' demanded Calvert. It was

several minutes before he got even the first approximation to an answer.

The columns were not transparent from every angle or under all illuminations. As one walked around them, objects would suddenly flash into view, apparently embedded in their depths like flies in amber - and would then disappear again. There were dozens of them, all different. They looked absolutely real and solid, yet many seemed to occupy the identical volume of space.

'Holograms,' said Calvert. 'Just like a museum on Earth.'

That was the obvious explanation, and therefore Norton viewed it with suspicion. His doubts grew as he examined the other columns, and conjured up the images stored in their interiors.

Hand-tools (though for huge and peculiar hands), containers, small machines with keyboards that appeared to have been made for more than five fingers, scientific instruments, startlingly conventional domestic utensils, including knives and plates which apart from their size would not have attracted a second glance on any terres-

trial table ... they were all there, with hundreds of less identifiable objects, often jumbled up together in the same pillar. A museum, surely, would have some logical arrangement, some segregation of related items. This seemed to be a completely random collection of hardware.

They had photographed the elusive images inside a score of the crystal pillars when the sheer variety of items gave Norton a clue. Perhaps this was not a collection, but a catalogue, indexed according to some arbitrary but perfectly logical system. He thought of the wild juxtapositions that any dictionary or alphabetized list will give, and tried the idea on his companions.

'I see what you mean,' said Mercer. 'The Ramans might be equally surprised to find us putting - ah - camshafts next to cameras.'

'Or books beside boots', added Calvert, after several seconds' hard thinking. One could play this game for hours, he decided, with increasing degrees of impropriety.

'That's the idea,' replied Norton. 'This may be an indexed catalogue for 3-D images - templates - solid blueprints, if you like to call them that.'

'For what purpose?'

'Well, you know the theory about the biots ... the idea that they don't exist until they're needed and then they're created - synthesized - from patterns stored somewhere?'

'I see,' said Mercer slowly and thoughtfully. 'So when a Raman needs a left-handed blivet, he punches out the correct code number, and a copy is manufactured from the pattern in here.'

'Something like that. But please don't ask me about the practical details.'

The pillars through which they had been moving had been steadily growing in size, and were now more than two metres in diameter. The images were correspondingly larger; it was obvious that, for doubtless excellent reasons, the Ramans believed in sticking to a one-to-one scale. Norton wondered how they stored anything really big, if this was the case.

To increase their rate of coverage, the four explorers had now spread out through the crystal columns and were taking photographs as quickly as they could get their cameras focused on the fleeting images. This was an astonishing piece of luck, Norton told himself, though he felt that he had earned it; they could not possibly have made a better choice than this Illustrated Catalogue of

Raman Artifacts. And yet, in another way; it could hardly have been more frustrating. There was nothing actually here, except impalpable patterns of light and darkness; these apparently solid objects did not really exist.

Even knowing this, more than once Norton felt an almost irresistible urge to laser his way into one of the pillars, so that he could have something material to take back to Earth. It was the same impulse, he told himself wryly, that would prompt a monkey to grab the reflection of a banana in a mirror.

He was photographing what seemed to be some kind of optical device when Calvert's shout started him running through the pillars.

'Skipper - Karl - Will - look at this!'

Joe was prone to sudden enthusiasms, but what he had found was enough to justify any amount of excitement.

Inside one of the two-metre columns was an elaborate harness, or uniform, obviously made for a vertically-standing creature, much taller than a man. A very narrow central metal band apparently surrounded the waist, thorax or some division unknown to terrestrial zoology. From this rose three slim columns, tapering outwards and ending in a perfectly circular belt, an impressive metre in diameter. Loops equally spaced along it could only be intended to go round upper limbs or arms. Three of them...

There were numerous pouches, buckles, bandoliers from which tools (or weapons?) protruded, pipes and electrical conductors, even small black boxes that would have looked perfectly at home in an electronics lab on Earth. The whole arrangement was almost as complex as a spacesuit, though it obviously provided only partial covering for the creature wearing it.

And was that creature a Raman? Norton asked himself. We'll probably never know; but it must have been intelligent - no mere animal could cope with all that sophisticated equipment.

'About two and a half metres high,' said Mercer thoughtfully, 'not counting the bead - whatever that was like.'

'With three arms - and presumably three legs. The same plan as the Spiders, on a much more massive scale. Do you suppose that's a coincidence?'

'Probably not. We design robots in our own image; we might expect the Ramans to do the same.'

Joe Calvert, unusually subdued, was looking at the display with something like awe.

'Do you suppose they know we're here?' he half-whispered.

'I doubt it,' said Mercer. 'We've not even reached their threshold of consciousness - though the Hermians certainly had a good try.'

They were still standing there, unable to drag themselves away, when Pieter called from the Hub, his voice full of urgent concern.

'Skipper - you'd better get outside.'

'What is it - biots heading this way?'

'No - something much more serious. The lights are going out.'

CHAPTER FORTY-THREE - Retreat

When he hastily emerged from the hole they had lasered, it seemed to Norton that the six suns of Rama were as brilliant as ever. Surely, he thought, Pieter must have made a mistake.., that's not like him at all ...

But Pieter had anticipated just this reaction.

'It happened so slowly,' he explained apologetically, 'that it was a long time before I noticed any difference. But there's no doubt about it - I've taken a meter reading. The light level's down forty per cent.'

Now, as his eyes readjusted themselves after the gloom of the glass temple, Norton could believe him. The long day of Rama was drawing to its close.

It was still as warm as ever, yet Norton felt himself shivering. He had known this sensation once before, during a beautiful summer day on Earth. There had been an inexplicable weakening of light as if darkness was falling from the air, or the sun had lost its strength - though there was not a cloud in the sky. Then he remembered; a partial eclipse was in progress.

'This is it,' he said grimly. 'We're going home. Leave all the equipment behind - we won't need it again.'

Now, he hoped, one piece of planning was about to prove its worth. He had selected London for this raid because no other town was so close to a stairway; the foot of Beta was only four kilometres away.

They set off at the steady, loping trot which was the most comfortable mode of travelling at half a gravity.

Norton set a pace which, he estimated, would get them to the edge of the plain without exhaustion, and in the minimum of time. He was acutely aware of the eight kilometres they would still have to climb when they had reached Beta, but he would feel much safer when they had actually started the ascent.

The first tremor came when they had almost reached the stairway. It was very slight, and instinctively Norton turned towards the south, expecting to see another display of fireworks around the Horns. But Rama never seemed to repeat itself exactly; if there were any electrical discharges above those needle-sharp mountains, they were too faint to be seen.

'Bridge,' he called, 'did you notice that?'

'Yes, Skipper - very small shock. Could be another attitude change. We're watching the rate gyro - nothing yet. Just a minute! Positive reading! Can just detect it - less than a microradian per second, but holding.'

So Rama was beginning to turn, though with almost imperceptible slowness. Those earlier shocks might have been a false alarm - but this, surely, was the real thing.

'Rate increasing five microrad. Hello, did you feel that shock?'

'We certainly did. Get all the ship's systems operational. We may have to leave in a hurry.'

'Do you expect an orbit change already? We're still a long way from perihelion.

'I don't think Rama works by our textbooks. Nearly at Beta. We'll rest there for five minutes.'

Five minutes was utterly inadequate, yet it seemed an age. For there was now no doubt that the light was failing, and failing fast.

Though they were all equipped with flashlights, the thought of darkness here was now intolerable; they had grown so psychologically accustomed to the endless day that it was hard to remember the conditions under which they had first explored this world. They felt an overwhelming urge to escape - to get out into the light of the Sun, a kilometre away on the other side of these cylindrical walls.

'Hub Control!' called Norton. 'Is the searchlight operating? We may need it in a hurry.'

'Yes, Skipper. Here it comes.

A reassuring spark of light started to shine eight kilometres above their heads. Even against the now fading day of Rama, it looked surprisingly feeble; but it had served them before, and would guide them once again if they needed it.

This, Norton was grimly aware, would be the longest and most nerve-wracking climb they had ever done. Whatever happened, it would be impossible to hurry; if they over-exerted themselves, they would simply collapse somewhere on that vertiginous slope, and would have to wait until their protesting muscles permitted them to continue. By this time, they must be one of the fittest crews that had ever carried out a space mission; but there were limits to what flesh and blood could do.

After an hour's steady plodding they had reached the fourth section of the stairway, about three kilometres from the plain. From now on, it would be much easier; gravity was already down to a third of Earth value. Although there had been minor shocks from time to time, no other unusual phenomena had occurred, and there was still plenty of light. They began to feel more optimistic, and even to wonder if they had left too soon. One thing was certain, however; there was no going back. They had all walked for the last time on the plain of Rama.

It was while they were taking a ten-minute rest on the fourth platform that Joe Calvert suddenly exclaimed:
• 'What's that noise, Skipper?'

'Noise! - I don't hear anything.'

'High-pitched whistle - dropping in frequency, you must hear it.'

'Your ears are younger than mine - oh, now I do.'

The whistle seemed to come from everywhere. Soon it was loud, even piercing, and falling swiftly in pitch. Then it suddenly stopped.

A few seconds later it came again, repeating the same sequence. It had all the mournful, compelling quality of a lighthouse siren sending out its warnings into the fog-shrouded night. There was a message here, and an urgent one. It was not designed for their ears, but they understood it. Then, as if to make doubly sure, it was reinforced by the lights themselves.

They dimmed almost to extinction, then started to flash. Brilliant beads, like ball lightning, raced along the six narrow valleys that had once illuminated this world. They moved from both Poles towards the Sea in a synchronized, hypnotic rhythm which could have only one meaning. 'To the Sea!' the lights were calling, 'To the

Sea I' And the summons was hard to resist; there was not a man who did not feel a compulsion to turn back, and to seek oblivion in the water of Rama.

'Hub Control!' Norton called urgently. 'Can you see what's happening?'

The voice of Pieter came back to him; he sounded awed, and more than a little frightened.

'Yes, Skipper. I'm looking across at the Southern continent. There are still scores of biots over there - including some big ones. Cranes; Bulldozers - lots of Scavengers. And they're all rushing back to the Sea faster than I've ever seen them move before. There goes a Crane - right over the edge! Just like Jimmy, but going down a lot quicker ... it smashed to pieces when it hit ... and here come the Sharks - they're tearing into it... ugh; it's not a pleasant sight...

'Now I'm looking at the plain. Here's a Bulldozer that seems to have broken down ... it's going round and round in circles. Now a couple of Crabs are tearing into it, pulling it to pieces ... Skipper, I think you'd better get back right away.'

'Believe me,' Norton said with deep feeling, 'we're coming just as quickly as we can.

Rama was battening down the hatches, like a ship preparing for a storm. That was Norton's overwhelming impression, though he could not have put it on a logical basis. He no longer felt completely rational; two compulsions were warring in his mind - the need to escape, and the desire to obey those bolts of lightning, that still flashed across the sky, ordering him to join the biots in their march to the sea.

One more section of stairway - another ten-minute pause, to let the fatigue poisons drain from his muscles. Then on again - another two kilometres to go, but let's try not to think about that-
The maddening sequence of descending whistles abruptly ceased. At the same moment, the fireballs racing along the slots of the Straight Valleys stopped their seaward strobing; Rama's six linear suns were once more continuous bands of light.

But they were fading fast, and sometimes they flickered, as if tremendous jolts of energy were being drained from waning power sources. From time to time, there were slight tremors underfoot; the bridge reported that Rama was still swinging with imperceptible slowness, like a compass needle responding to a weak magnetic field. This was perhaps reassuring; it was when Rama stopped its swing that Norton would really begin to worry.

All the biots had gone, so Pieter reported. In the whole interior of Rama, the only movement was that of human beings, crawling with painful slowness up the curving face of the north dome.

Norton had long since overcome the vertigo he had felt on that first ascent, but now a new fear was beginning to creep into his mind. They were so vulnerable here, on this endless climb from plain to Hub. Suppose that, when it had completed its attitude change, Rama started to accelerate?

Presumably its thrust would be along the axis. If it was in the northward direction, that would be no problem; they would be held a little more firmly against the slope which they were ascending. But if it was towards the south, they might be swept off into space, to fall back eventually on the plain far below.

He tried to reassure himself with the thought that any possible acceleration would be very feeble. Dr Perera's calculations had been most convincing; Rama could not possibly accelerate at more than a fiftieth of a gravity, or the Cylindrical Sea would climb the southern cliff and flood an entire continent. But Perera had been in a comfortable study back on Earth, not with kilometres of overhanging metal apparently about to crash down upon his head. And perhaps Rama was designed for periodic flooding-

No, that was ridiculous. It was absurd to imagine that all these trillions of tons could suddenly start moving with sufficient acceleration to shake him loose. Nevertheless, for all the remainder of the ascent, Norton never let himself get far from the security of the handrail. Lifetimes later, the stairway ended; - only a few hundred metres of vertical, recessed ladder were left. It was no longer necessary to climb this section since one man at the Hub, hauling on a cable, could easily hoist another against the rapidly diminishing gravity. Even at the bottom of the ladder a man weighed less than five kilos; at the top, practically zero.

So Norton relaxed in the sling, grasping a rung from time to time to counter the feeble Coriolis force still trying to push him off the ladder. He almost forgot his knotted muscles, as he had his last view of Rama.
It was about as bright now as a full moon on Earth; the overall scene was perfectly clear, but he could no longer make out the finer details. The South Pole was now partially obscured by a glowing mist; only the peak of Big Horn protruded through it - a small, black dot, seen exactly head-on.

The carefully-mapped but still unknown continent beyond the Sea was the same apparently random patchwork that it had always been. It was too foreshortened, and too

full of complex detail, to reward visual examination, and Norton scanned it only briefly.

He swept his eyes round the encircling band of the Sea, and noticed for the first time a regular pattern of disturbed water, as if waves were breaking over reefs set at geometrically precise intervals. Rama's manoeuvring was having some effect, but a very slight one. He was sure that Sergeant Barnes would have sailed forth happily under these conditions, had he asked her to cross the Sea in her lost Resolution.

New York, London, Paris, Moscow, Rome ... he said farewell to all the cities of the northern continent, and hoped the Ramans would forgive him for any damage he had done. Perhaps they would understand that it was all in the cause of science.

Then, suddenly, he was at the Hub, and eager hands reached out to grab him, and to hurry him through the airlocks. His overstrained legs and arms were trembling so uncontrollably that he was almost unable to help himself, and he was content to be handled like a half-paralysed invalid.

The sky of Rama contracted above him, as he descended into the central crater of the Hub. As the door of the inner airlock shut off the view for ever, he found himself thinking: 'How strange that night should be falling, now that Rama is closest to the sun!'

CHAPTER FORTY-FOUR - Space Drive

A hundred kilometres was an adequate safety margin, Norton had decided. Rama was now a huge black rectangle, exactly broadside-on, eclipsing the sun. He had used this opportunity to fly Endeavour completely into shadow, so that the load could be taken off the ship's cooling systems and some overdue maintenance could be carried out. Rama's protective cone of darkness might disappear at any moment, and he intended to make as much use of it as he could.

Rama was still turning; it had now swung through almost fifteen degrees, and it was impossible to believe that some major orbit change was not imminent. On the United Planets, excitement had now reached a pitch of hysteria, but only a faint echo of this came to Endeavour. Physically and emotionally, her crew was exhausted; apart from a skeleton watch, everyone had slept for twelve hours after take-off from the North Polar Base. On doctor's orders, Norton himself had used electro-sedation; even so, he had dreamed that he was climbing an infinite stairway.

The second day back on ship, everything had almost returned to normal; the exploration of Rama already

seemed part of another life. Norton started to deal with the accumulated office work and to make plans for the future; but he refused the requests for interviews that had somehow managed to insinuate themselves into the Survey and even SPACEGUARD radio circuits. There were no messages from Mercury, and the UP General Assembly had adjourned its session, though it was ready to meet again at an hour's notice.

Norton was having his first good night's sleep, thirty hours after leaving Rama, when he was rudely shaken back to consciousness. He cursed groggily, opened a bleary eye at Karl Mercer - and then, like any good commander, was instantly wide awake.

'It's stopped turning?'

'Yes. Steady as a rock.'

'Let's go to the bridge.'

The whole ship was awake; even the simps knew that something was afoot, and made anxious, meeping noises until Sergeant McAndrews reassured them with swift hand-signals. Yet as Norton slipped into his chair and fastened the restraints round his waist, he wondered if this might be yet another false alarm.

Rama was now foreshortened into a stubby cylinder, and the searing rim of the sun had peeked over one edge. Norton jockeyed Endeavour gently back into the umbra of the artificial eclipse, and saw the pearly splendour of the corona reappear across a background of the brighter stars. There was one huge prominence, at least half a million kilometres high, that had climbed so far from the sun that its upper branches looked like a tree of crimson fire.

So now we have to wait, Norton told himself. The important thing is not to get bored, to be ready to react at a moment's notice, to keep all the instruments aligned and recording, no matter how long it takes

That was strange. The star field was shifting, almost as if he had actuated the Roll thrusters. But he had touched no controls, and if there had been any real movement, he would have sensed it at once.

'Skipper!' said Calvert urgently from the Nay position, 'we're rolling - look at the stars! But I'm getting no instrument readings!'
'Rate gyros operating?'

'Perfectly normal - I can see the zero jitter. But we're rolling several degrees a second!'

'That's impossible!'

'Of course it is - but look for yourself...'

When all else failed, a man had to rely on eyeball instrumentation. Norton could not doubt that the star field was indeed slowly rotating - there went Sirius, across the rim of the port. Either the universe, in a reversion of pre-Copernican cosmology, had suddenly decided to revolve around Endeavour; or the stars were standing still, and the ship was turning.

The second explanation seemed rather more likely, yet it involved apparently insoluble paradoxes. If the ship was really turning at this rate, he would have felt it - literally by the seat of his pants, as the old saying went. And the gyros could not all have failed, simultaneously and independently.

Only one answer remained. Every atom of Endeavour must be in the grip of some force - and only a powerful gravitational field could produce this effect. At least, no other known field...

Suddenly, the stars vanished. The blazing disc of the sun had emerged from behind the shield of Rama, and its glare had driven them from the sky.

'Can you get a radar reading? What's the doppler?'

Norton was fully prepared to find that this too was inoperative, but he was wrong.

Rama was under way at last, accelerating at the modest rate of O.O15 gravities. Dr Perera, Norton told himself, would be pleased; he had predicted a maximum of 0.02. And Endeavour was somehow caught in its wake like a piece of flotsam, whirling round and round behind a speeding ship...

Hour after hour, that acceleration held constant; Rama was falling away from Endeavour at steadily increasing speed. As its distance grew, the anomalous behaviour of the ship slowly ceased; the normal laws of inertia started to operate again. They could only guess at the energies in whose backlash they had been briefly caught, and Norton was thankful that he had stationed Endeavour at a safe distance before Rama had switched on its drive.

As to the nature of that drive, one thing was now certain, even though all else was mystery. There were no jets of gas, no beams of ions or plasma thrusting Rama into its new orbit. No one put it better than Sergeant-Professor Myron when he said, in shocked disbelief: 'There goes Newton's Third Law.'

It was Newton's Third law, however, upon which En-

deavour had to depend the next day, when she used her very last reserves of propellent to bend her own orbit outwards from the sun. The change was slight, but it would increase her perihelion distance by ten million kilometres. That was the difference between running the ship's cooling system at ninety-five per cent capacity - and a certain fiery death.

When they had completed their own manoeuvre, Rama was two hundred thousand kilometres away, and difficult to see against the glare of the sun. But they could still obtain accurate radar measurements of its orbit; and the more they observed, the more puzzled they became.

They checked the figures over and over again, until there was no escaping from the unbelievable conclusion. It looked as if all the fears of the Hermians, the heroics of Rodrigo, and the rhetoric of the General Assembly, had been utterly in vain.

What a cosmic irony, said Norton as he looked at his final figures, if after a million years of safe guidance Rama's computers had made one trifling error - perhaps changing the sign of an equation from plus to minus.

Everyone had been so certain that Rama would lose speed, so that it could be captured by the sun's gravity and thus become a new planet of the solar system. It was doing just the opposite.

It was gaining speed - and in the worst possible direction.

Rama was falling ever more swiftly into the sun.

CHAPTER FORTY-FIVE - Phoenix

As the details of its new orbit became more and more clearly defined, it was hard to see how Rama could possibly escape disaster. Only a handful of comets had ever passed as close to the sun; at perihelion, it would be less than half a million kilometres above that inferno of fusing hydrogen. No solid material could withstand the temperature of such an approach; the tough alloy that comprised Rama's hull would start to melt at ten times that distance.

Endeavour had now passed its own perihelion, to everyone's relief, and was slowly increasing its distance from the sun. Rama was far ahead on its closer, swifter orbit, and already appeared well inside the outermost fringes of the corona. The ship would have a grandstand view of the drama's final stage.

Then, five million kilometres from the sun, and still

accelerating, Rama started to spin its cocoon. Until now,, it had been visible under the maximum power of Endeavour's telescopes as a tiny bright bar; suddenly it began to scintillate, like a star seen through horizon mists. It almost seemed as if it was disintegrating; When he saw the image breaking up, Norton felt a poignant sense of grief at the loss of so much wonder. Then he realized that Rama was still there, but that it was surrounded by a shimmering haze.

And then it was gone. In its place was a brilliant, star-like object, showing no visible disc - as if Rama had suddenly contracted into a tiny ball.

It was some time before they realized what had happened. Rama had indeed disappeared: it was now surrounded by a perfectly reflecting sphere, about a hundred kilometres in diameter. All that they could now see was the reflection of the sun itself, on the curved portion that was closest to them. Behind this protective bubble, Rama was presumably safe from the solar inferno.

As the hours passed, the bubble changed its shape. The image of the sun became elongated, distorted. The sphere was turning into an ellipsoid, its long axis pointed in the direction of Rama's flight. It was then that the first anomalous reports started coming in from the robot observatories, which, for almost two hundred years, had been keeping a permanent watch on the sun.

Something was happening to the solar magnetic field, in the region around Rama. The million-kilometre-long lines of force that threaded the corona, and drove its wisps of fiercely ionized gas at speeds which sometimes defied even the crushing gravity of the sun, were shaping themselves around that glittering ellipsoid. Nothing was yet visible to the eye, but the orbiting instruments reported every change in magnetic flux and ultra-violet radiation.

And presently, even the eye could see the changes in the corona. A faintly-glowing tube or tunnel, a hundred thousand kilometres long, had appeared high in the outer atmosphere of the sun. It was slightly curved, bending along the orbit which Rama was tracing, and Rama itself - or the protective cocoon around it - was visible as a glittering head racing faster and faster down that ghostly tube through the corona.

For it was still gaining speed; now it was moving at more than two thousand kilometres a second, and there was no question of it ever remaining a captive of the sun. Now, at last, the Raman strategy was obvious; they had come so close to the sun merely to tap its energy at the source, and to speed themselves even faster on the way to their ultimate unknown goal ...

And presently it seemed that they were tapping more than energy. No one could ever be certain of this, because the nearest observing instruments were thirty million kilometres away, but there were definite indications that matter was flowing from the sun into Rama itself, as if it was replacing the leakages and losses of ten thousand centuries in space.

Faster and faster Rama swept around the sun moving now more swiftly than any object that had ever travelled through the solar system. In less than two hours, its direction of motion had swung through more than ninety degrees, and it had given a final, almost contemptuous proof of its total lack of interest in all the worlds whose peace of mind it had so rudely disturbed.

It was dropping out of the Ecliptic, down into the southern sky, far below the plane in which all the planets move. Though that, surely, could not be its ultimate goal, it was aimed squarely at the Greater Magellanic Cloud, and the lonely gulfs beyond the Milky Way.

CHAPTER FORTY-SIX - Interlude

'Come in,' said Commander Norton absentmindedly at the quiet knock on his door.

'Some news for you, Bill. I wanted to give it first, before the crew gets into the act. And anyway, it's my department.'

Norton still seemed far away. He was lying with his hands clasped under his head, eyes half shut, cabin light low - not really drowsing, but lost in some reverie or private dream.

He blinked once or twice, and was suddenly back in his body.

'Sorry Laura - I don't understand. What's it all about?'

'Don't say you've forgotten!'

'Stop teasing, you wretched woman. I've had a few things on my mind recently.'

Surgeon-Commander Ernst slid a captive chair across in its slots and sat down beside him.

'Though interplanetary crises come and go, the wheels of Martian bureaucracy grind steadily away. But I suppose Rama helped. Good thing you didn't have to get permission from the Hermians as well.'

Light was dawning.

'Oh - Port Lowell has issued the permit!'

'Better than that - it's already being acted On.' Laura glanced at the slip of paper in her hand. 'Immediate,' she read. Probably right now, your new son is being conceived. Congratulations.'

Thank you. I hope he hasn't minded the wait.'

Like every astronaut, Norton had been sterilized when he entered the service; for a man who would spend years in space, radiation-induced mutation was not a risk - it was a certainty. The spermatazoon that had just delivered its cargo of genes on Mars, two hundred million kilometres away, had been frozen for thirty years, awaiting its moment of destiny.

Norton wondered if he would be home in time for the birth. He had earned rest, relaxation - such normal family life as an astronaut could ever know. Now that the mission was essentially over, he was beginning to unwind, and to think once more about his own future, and that of both his families. Yes, it would be good to be home for a while, and to make up for lost time - in many ways...

'This visit,' protested Laura rather feebly, 'was purely in a professional capacity.'

'After all these years,' replied Norton, 'we know each other better than that. Anyway, you're off duty now.'

'Now what are you thinking?' demanded Surgeon-Commander Ernst, very much later. 'You're not becoming sentimental, I hope.'

'Not about us. About Rama. I'm beginning to miss it.'

'Thanks very much for the compliment.'

Norton tightened his arms around her. One of the nicest things about weightlessness, he often thought, was that you could really hold someone all night, without cutting off the circulation. There were those who claimed that love at one gee was so ponderous that they could no longer enjoy it.

'It's a well-known fact, Laura, that men, unlike women, have two-track minds. But seriously - well, more seriously - I do feel a sense of loss.'

'I can understand that.'

'Don't be so clinical; that's not the only reason. Oh, never mind.' He gave up. It was not easy to explain, even to himself.

He had succeeded beyond all reasonable expectation; what his men had discovered in Rama would keep scientists busy for decades. And, above all, he had done it without a single casualty.

But he had also failed. One might speculate endlessly, but the nature and the purpose of the Ramans was still utterly unknown. They had used the solar system as a refuelling stop - as a booster station - call it what you will, and had then spurned it completely, on their way to more important business. They would probably never even know that the human race existed; such monumental indifference was worse than any deliberate insult.

When Norton bad glimpsed Rama for the last time, a tiny star hurtling outwards beyond Venus, he knew that part of his life was over. He was only fifty-five, but he felt he had left his youth down there on the curving plain, among mysteries and wonders now receding inexorably beyond the reach of man. Whatever honours and achievements the future brought him, for the rest of his life he would be haunted by a sense of anticlimax, and the knowledge of opportunities missed.

So he told himself; but even then, he should have known better.

And on far-off Earth, Dr Carlisle Perera had as yet told no one how he had woken from a restless sleep with the message from his subconscious still echoing in his brain:

The Ramans do everything in threes.

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EOF

Silence Please

Arthur C. Clarke

1954 Popular Publications Inc.

You come upon the "White Hart" quite unexpectedly in one of these anonymous little lanes leading down from Fleet Street to the Embankment. It's no use telling you where it is: very few people who have set out in a determined effort to get there have ever actually arrived. For the first dozen visits a guide is essential: after that you'll probably be all right if you close your eyes and rely on instinct. Also-to be perfectly frank-we don't want any more customers, at least on our night. The place is already uncomfortably crowded. All that I'll say about its location is that it shakes occasionally with the vibration of newspaper presses, and that if you crane out of the window of the gents' room you can just see the Thames.

From the outside, it looks like any other pub-as indeed it is for five days of the week. The public and saloon bars are on the ground floor: there are the usual vistas of brown oak paneling and frosted glass, the bottles behind the bar, the handles of the beer engines . . . nothing out of the ordinary at all. Indeed, the only concession to the twentieth century is the juke box in the public bar. It was installed during the war in a laughable attempt to make G.I.'s feel at home, and one of the first things we did was to make sure there was no danger of its ever working again.

At this point I had better explain who "we" are. That is not as easy as I thought it was going to be when I started, for a complete catalogue of the "White Hart's" clients would probably be impossible and would certainly be excruciatingly tedious. So all I'll say at this point is that "we" fall into three main classes. First there. are the journalists, writers and editors. The journalists, of course,

gravitated here from Fleet Street. Those who couldn't make the grade fled elsewhere: the tougher ones remained. As for the writers ' most of them heard about us from other writers, came here for copy, and got trapped.

Where there are writers, of course, there are sooner or later editors. If Drew, our landlord, got a percentage on the literary business done in his bar, he'd be a rich man. (We suspect he is a rich man, anyway.) One of our wits once remarked that it was a common sight to see half a dozen indignant authors arguing with a hard faced editor in one corner of the "White Hart", while in another, half a dozen indignant editors argued with a hard-faced author.

So much for the literary side: you will have, I'd better warn you, ample opportunities for close-ups later. Now let us glance briefly at the scientists. How did they get in here?

Well, Birkbeck College is only across the road, and King's is just a few hundred yards along the Strand. That's doubtless part of the explanation, and again personal recommendation had a lot. to do with it. Also, many of our scientists are writers, and not a few of our writers are scientists. Confusing, but we like it that way.

The third portion of our little microcosm consists of what may be loosely termed "interested laymen". They were attracted to the "White Hart" by the general brouhaha, and enjoyed the conversation and company so much that they now come along regularly every Wednesday-which is the day when we all get together. Sometimes they can't stand the pace and fall by the wayside, but there's always a fresh supply.

With such potent ingredients, it is hardly surprising that Wednesday at the "White Hart" is seldom dull. Not only have some remarkable stories been told there, but remarkable things have happened there. For example, there was the time when Professor --, passing through on his way to Harwell, left behind a brief-case containing-well, we'd better not go into that, even though we did so at the time. And most interesting it was, too . . . . Any Russian agents will find me in the corner under the dartboard. I come high, but easy terms can be arranged.

Now that I've finally thought of the idea, it seems astonishing to me that none of my colleagues has ever got round to writing up these stories. Is it a question of being so close to the wood that they can't see the trees? Or is it lack of incentive? No, the last

explanation can hardly hold: several of them are quite as hard up as I am, and have complained with equal bitterness about Drew's "NO CREDIT" rule. My only fear, as I type these words on my old Remington Noiseless, is that John Christopher or George Whitley or John Beynon are already hard at work using up the best material. Such as, for instance, the story of the Fenton Silencer . . . .

I don't know when it began: one Wednesday is much Re another and it's hard to tag dates on to them. Besides, people may spend a couple of months lost in the "White Hart" crowd before you first notice their existence. That had probably happened to Harry Purvis, because when 1. first came aware of him he already knew the names of most of the people in our crowd. Which is more than I do these days, now that I come to think of it.

But though I don't know when, I know exactly how it all started. Bert Huggins was the catalyst, or, to be more accurate, his voice was. Bert's voice would catalyse anything. When he indulges in a confidential whisper, it sounds like a sergeant major drilling an entire regiment. And when he lets himself go, conversation languishes elsewhere while we all. wait for those cute little bones in the inner ear to resume their accustomed places.

He had just lost his temper with John Christopher (we all do this at some time or other) and the resulting detonation had disturbed the chess game in progress at the back of the saloon bar. As usual, the two players were surrounded by backseat drivers, and we all looked up with a start as Bert's blast whammed overhead. When the echoes died away, someone said: "I wish there was a way of shutting him up."

It was then that Harry Purvis replied: "There is, you know."

Not recognizing the voice, I looked round. I saw a small, neatly dressed man in the late thirties. He was smoking one of those carved German pipes that always make me think of cuckoo clocks and the Black Forest. That was the only unconventional thing about him: otherwise he might have been a minor Treasury official all dressed up to go to a meeting of the Public Accounts Committee.

"I beg your pardon?" I said.

He took no notice, but made some delicate adjustments to his pipe. It was then that I noticed that it wasn't, as I'd thought at

first glance, an elaborate piece of wood carving. It was something much more sophisticated-a contraption of metal and plastic like a small chemical engineering plant. There were even a couple of minute, valves. My God, it was a chemical engineering plant . . . .

I don't goggle any more easily than the next man, but I made no attempt to hide my curiosity. He gave me a superior smile.

"All for the cause of science. It's an idea of the Biophysics Lab. They want to find out exactly what there is in tobacco smoke hence these filters. You know the old argument-does smoking cause cancer of the tongue, and if so, how? The trouble is that it takes an awful lot of-er-distillate to identify some of the obscurer by-products. So we have to do a lot of smoking."

"Doesn't it spoil the pleasure to have all this plumbing in the way?"

"I don't know. You see, I'm just a volunteer. I don't smoke."

"Oh," I said. For the moment, that seemed the only reply. Then I remembered how the conversation had started.

"You were saying," I continued with some feeling, for there was still a slight tintinus in my left ear, "that there was some way of shutting up Bert. We'd all like to hear it-if that isn't mixing metaphors somewhat."

"I was thinking," he replied, after a couple of experimental sucks and blows, "of the ill-fated Fenton Silencer. A sad story yet, I feel, one with an interesting lesson for us all. And one day who knows?-someone may perfect it and earn the blessings of the world.

Suck, bubble ' bubble, plop . . . .

"Well, let's hear the story. When did it happen?"

He sighed.

"I'm almost sorry I mentioned it. Still, since you insist-and, of course, on the understanding that it doesn't go beyond these walls."

"Er-of course."

"Well, Rupert Fenton was one of our lab assistants. A very bright youngster, with a good mechanical background, but, naturally, not very well up in theory. He was always making gadgets in his spare time. Usually the idea was good, but as he was shaky on fundamentals the things hardly ever worked. That didn't-seem to discourage him: I think he fancied himself as a latter-day Edison, and imagined he could make his fortune from the radio tubes and

other oddments lying around the lab. As his tinkering didn't interfere with his work, no-one objected, indeed, the physics demonstrators did their best to encourage him, because, after all, there is something refreshing about any form of enthusiasm. But no-one expected he'd ever get very far, because I don't suppose he could even integrate e to the x."

as such ignorance possible?" gasped someone.

"Maybe I exaggerate. Let's say x e to the x. Anyway, all his knowledge was entirely practical-rule of thumb, you know. Give him a wiring diagram, however complicated, and he could make the apparatus for you. But unless it was something really simple, like a television set, he wouldn't understand how it worked. The trouble was, he didn't realize his limitations. And that, as you'll see, was most unfortunate.

“I think he must have got the idea while watching the Honours Physics students doing some experiments in acoustics. I take it, of course, that you all understand the phenomenon of interference,?”

“Naturally,” I replied.

“Hey!” said one of the chess-players, who had given up trying to concentrate on the game (probably because he was losing). “I don’t.”

Purvis looked at him as though seeing something that had no right to be around in a world that had invented penicillin.

“In that case,” he said coldly, “I suppose I had better do some

explaining.” He waved aside our indignant protests. “No, I insist.

It’s precisely those who don’t understand these things who need to

be told about them. If someone had only explained the theory to

poor Fenton while there was ‘ s still time 1,

He looked down at the now thoroughly abashed chess-player.

“I do not know,” he began, “if you have ever considered the nature of sound. Suffice to say that it consists of a series of waves moving through the air. Not, however, waves like those on the surface of the sea-oh dear no! Those waves are up and down movements. Sound waves consist of alternate compressions and rarefactions.”

“Rare-what?”

“Rarefactions.”

“Don’t you mean ‘rarefications’?”

“I do not. I doubt if such a word exists, and if it does, it

shouldn’t,” retorted Purvis, with the aplomb of Sir Alan Herbert dropping a particularly revolting neologism into his killing-bottle. “Where was I? Explaining sound, of course. When we make any sort of noise, from the faintest whisper to that concussion that went past just now, a series of pressure changes moves through the air. Have you ever watched shunting engines at work on a siding? You see a perfect example of the same kind of thing. There’s a long line of goods-wagons, all coupled together. One end gets a bang, the first two trucks move together-and then you can see the compression wave moving right along the line. Behind it the reverse thing happens-the rarefaction-I repeat, rarefaction-as the trucks separate again.

“Things are simple enough when there is only one source of sound-only one set of waves. But suppose you have two wave patterns, moving in the same direction? That’s when interference arises, and there are lots of pretty experiments in elementary physics to demonstrate it. All we need worry about here is, the fact-which I think you will all agree is perfectly obvious-that if one could get two sets of waves exactly out of step, the total result would be precisely zero. The compression pulse of one sound wave would be on top of the rarefaction of another-net result-no change and hence no sound. To go back to my analogy of the line of wagons, it’s as if you gave the last truck a jerk and a push simultaneously. Nothing at all would happen.

“Doubtless some of you will already see what I am driving at, and will appreciate the basic principle of the Fenton Silencer. Young Fenton, I imagine, argued in this manner. ‘This world of ours,’ lit said to himself, ‘is too full of noise. There would be a fortune for anyone who could invent a really perfect silencer. Now, what would that imply . . . T

“It didn’t take him long to work out the answer: I told you he was a bright lad. There was really very little in his pilot model. It consisted of a microphone, a special amplifier, and a pair of loudspeakers. Any sound that happened to be about was picked up by the mike, amplified and inverted so that it was exactly out of phase with the original noise. Then it was pumped out of the speakers, the original wave and the new one cancelled out, and the net result was silence.

“Of course, there was rather more to it than that. There had

to be an arrangement to make sure that the canceling wave was just the right intensity-otherwise you might be worse off than when you started. But these are technical details that I won’t bore you with. As many of you will recognize, it’s a simple application of negative feed-back.”

“Just a moment!” interrupted Eric Maine. Eric, I should mention, is an electronics expert and edits some television paper or other. He’s also written a radio play about space-flight, but that’s another story. “Just a moment! There’s something wrong here. You couldn’t get silence that way. It would be impossible to arrange the phase . . .

Purvis jammed the pipe back in his mouth. For a moment there was an ominous bubbling and I thought of the first act of “Macbeth”. Then he fixed Eric with a glare.

“Are you suggesting,” he said frigidly, “that this story is untrue?”

“Ah-well, I won’t go as far as that, but Eric’s voice trailed away as if he had been silenced himself. He pulled an old envelope out of his pocket, together with an assortment of resistors and condensers that seemed to have got entangled in his handkerchief, and began to do some figuring. That was the last we heard from him for some time.

“As I was saying,” continued Purvis calmly, “that’s the way Fenton’s Silencer worked. His first model wasn’t very powerful, and it couldn’t deal with very high or very low notes. The result was rather odd. When it was switched on, and someone tried to talk, You’d hear the two ends of the spectrum-a faint bat’s squeak, and a kind of low rumble. But he soon got over that by using a more linear circuit (dammit, I can’t help using some technicalities!) and in the later model he was able to produce complete silence over quite a large area. Not merely an ordinary room, but a full-sized hall. Yes. . . .

“Now Fenton was not one of these secretive inventors who won’t tell anyone what they are trying to do, in case their ideas are stolen. He was all too willing to talk. He discussed his ideas with the staff and with the students, whenever he could get anyone to listen. It so happened that one of the first people to whom he demonstrated his-improved Silencer was a young Arts student called -I think-Kendall, who was taking Physics as a subsidiary subject.

Kendall was much impressed by the Silencer, as well he might be. But he was not thinking, as you may have imagined, about its commercial possibilities, or the boon it would bring to the outraged ears of suffering humanity. Oh dear no! He had quite other ideas.

“Please permit me a slight digression. At college we have a flourishing Musical Society, which in recent years has grown in numbers to such an extent that it can now tackle the less monumental symphonies. In the year of which I speak, it was embarking on a very ambitious enterprise. It was

going to produce a new opera, a work by a talented young composer whose name it would not be fair to mention, since it is now well-known to you all. Let us call him Edward England. I've forgotten the title of the work, but it was one of these stark dramas of tragic love which, for some reason I've never been able to understand, are supposed to be less ridiculous with a musical accompaniment than without. No doubt a good deal depends on the music.

"I can still remember reading the synopsis while waiting for the curtain to go up, and to this day have never been able to decide whether the libretto was meant seriously or not. Let's see-the period was the late Victorian era, and the main characters were Sarah Stampe, the passionate postmistress, Walter Partridge, the saturnine gamekeeper, and the squire's son, whose name I forget. It's the old story of the eternal triangle, complicated by the villager's resentment of change-in this case, the new telegraph system, which the local crones predict will Do Things to the cows' milk and cause trouble at lambing time.

"Ignoring the frills, it's the usual drama of operatic jealousy. The squire's son doesn't want to marry into the Post Office, and the gamekeeper, maddened by his rejection, plots revenge. The tragedy rises to its dreadful climax when poor Sarah, strangled with parcel tape, is found hidden in a mail-bag in the Dead Letter Department. The villagers hang Partridge from the nearest telegraph pole, much to the annoyance of the linesmen. He was supposed to sing an aria while he was being hung: that is one thing I regret missing. The squire's son takes to drink, or the Colonies, or both: and that's that.

"I'm sure you're wondering where all this is leading: please bear with me for a moment longer. The fact is that while this synthetic jealousy was being rehearsed, the real thing was going on back-

stage. Fenton's friend Kendall had been spurned by the young lady who was to play Sarah Stampe. I don't think he was a particularly vindictive person, but he saw an opportunity for a unique revenge. Let us be frank and admit that college life does breed a certain irresponsibility-and in identical circumstances, how many of us would have rejected the same chance?

"I see the dawning comprehension on your faces. But we, the audience, had no suspicion when the overture started on that memorable day. It was a most distinguished gathering: everyone was there, from the Chancellor downwards. Deans and professors were two a penny: I never did discover how so many people had been bullied into coming. Now that I come to think of it, I can't remember what I was doing there myself.

"The overture died away amid cheers, and, I must admit, occasional cat-calls from the more boisterous members of the audience. Perhaps I do them an injustice: they may have been the more musical ones.

"Then the curtain went up. The scene was the village square at Doddering Sloughleigh, circa 1860. Enter the heroine, reading the postcards in the morning's mail. She comes across a letter addressed to the young squire and promptly bursts into song.

"Sarah's opening aria wasn't quite as bad as the overture, but it was grim enough. Luckily, we were to hear only the first few bars . . . .

"Precisely. We need not worry about such details as how Kendall had talked the ingenuous Fenton into it-if, indeed, the inventor realized the use to which his device was being applied. All I need say is that it was a most convincing demonstration. There was a sudden, deadening blanket of silence, and Sarah Stampe just faded out like a TV program when the sound is turned off. Everyone was frozen in their seats, while the singer's lips went on moving silently. Then she too realized what

had happened. Her mouth opened in what would have been a piercing scream in any other circumstances, and she fled into the wings amid a shower of postcards.

"Thereafter, the chaos was unbelievable. For a few minutes everyone must have thought they had lost the sense of hearing, but soon they were able to tell from the behavior of their companions that they were not alone in their deprivation. Someone in the Physics

Department must have realized the truth fairly promptly, for soon little slips of paper were circulating among the V.I.P.'s in the front row. The Vice-Chancellor was rash enough to try and restore order by sign-language, waving frantically to the audience from the stage. By this time I was too sick with laughter to appreciate such fine details.

"There was nothing for it but to get out of the hall, which we all did as quickly as we could. I think Kendall had fled-he was so overcome by the effect of the gadget that he didn't stop to switch it off. He was afraid of staying around in case he was caught and lynched. As for Fenton-alas, we shall never know his side of the story. We can only reconstruct the subsequent events from the evidence that was left.

"As I picture it, he must have waited until the hall was empty, and then crept in to disconnect his apparatus. We heard the explosion all over the college."

"The explosion?" someone gasped.

"Of course. I shudder to think what a narrow escape we all had. Another dozen decibels, a few more phones-and it might have happened while the theatre was still packed. Regard it, if you like, as an example of the inscrutable workings of providence that only the inventor was caught in the explosion. Perhaps it was as went: at least he perished in the moment of achievement, and before the Dean could get at him."

"Stop moralizing, man. What happened?"

"Well, I told you that Fenton was very weak on theory. If he'd gone into the mathematics of the Silencer he'd have found his mistake. The trouble is, you see, that one can't destroy energy. Not even when you cancel out one train of waves by another. All that happens then is that the energy you've neutralized accumulates somewhere else. It's rather Re sweeping up all the dirt in a room - at the cost of an unsightly pile under the carpet.

"When you look into the theory of the thing, you'll find that Fenton's gadget wasn't a silencer so much as a collector of sound ' All the time it was switched on, it was really absorbing sound energy. And at that concert, it was certainly going flat out. You'll understand what I mean if you've ever looked at one of Edward England's scores. On top of that, of course, there was all the noise the audience was making-or I should say was trying to make-

during the resultant panic. The total amount of energy must have been terrific, and the poor Silencer had to keep on sucking it up. Where did it go? Well, I don't know the circuit details-probably into the condensers of the power pack. By the time Fenton started to tinker with it again, it was like a loaded bomb. The sound of his approaching footsteps was the last straw, and the overloaded apparatus could stand no more. It blew up."

For a moment no-one said a word, perhaps as a token of respect for the late Mr. Fenton. Then Eric Maine, who for the last ten minutes had been muttering in the corner over his calculations, pushed his way through the ring of listeners. He held a sheet of paper thrust aggressively in front of him.

“Hey!” he said. “I was right all the time. The thing couldn’t work. The phase and amplitude relations.

Purvis waved him away.

“That’s just what I’ve explained,” he said patiently. “You should have been listening. Too bad that Fenton found out the hard way.”

He glanced at his watch. For some reason, he now seemed in a hurry to leave.

“My goodness! Time’s getting on. One of these days, remind me to tell you about the extraordinary thing we saw through the new proton microscope. That’s an even more remarkable story.”

He was half way through the door before anyone else could challenge him. Then George Whitley recovered his breath.

“Look here,” he said in a perplexed voice. “How is it that we never heard about this business?”

Purvis paused on the threshold, his pipe now burbling briskly as it got into its stride once more. He glanced back over his shoulder.

“There was only one thing to do,” he replied. “We didn’t want a scandal-de mortuis nil nisi bonum, you know. Besides, in the circumstances, don’t you think it was highly appropriate to-a hush the whole business up? And a very good night to you all.”

Superiority

Arthur C. Clarke

In making this statement-which I do of my own free will-I wish first to make it perfectly clear that I am not in any way trying to gain sympathy, nor do I expect any mitigation of whatever sentence the Court may pronounce. I am writing this in an attempt to refute some of the lying reports broadcast over the prison radio and published in the papers I have been allowed to see. These have given an entirely false picture of the true cause of our defeat, and as the leader of my race's armed forces at the cessation of hostilities I feel it my duty to protest against such libels upon those who served under me.

I also hope that this statement may explain the reasons for the application I have twice made to the Court, and will now induce it to grant a favor for which I can see no possible grounds of refusal.

The ultimate cause of our failure was a simple one: despite all statements to the contrary, it was not due to lack of bravery on the part of our men, or to any fault of the Fleet's. We were defeated by one thing only-by the inferior science of our enemies. I repeat-by the inferior science of our enemies.

When the war opened we had no doubt of our ultimate victory. The combined fleets of our allies greatly exceeded in number and armament those which the enemy could muster against us, and in almost all branches of military science we were their superiors. We were sure that we could maintain this superiority. Our belief proved, alas, to be only too well founded.

At the opening of the war our main weapons were the long-range homing torpedo, dirigible ball-lightning and the various modifications of the Klydon beam. Every unit of the Fleet was equipped with these and though the enemy possessed similar weapons their installations were generally of lesser power. Moreover, we had behind us a far greater military Research Organization, and with this initial advantage we could not possibly lose.

The campaign proceeded according to plan until the Battle of the Five Suns. We won this, of course, but the opposition proved stronger than we had expected. It was realized that victory might be more difficult, and more delayed, than had first been imagined. A conference of supreme commanders was therefore called to discuss our future strategy.

Present for the first time at one of our war conferences was Professor-General Norden, the new Chief of the Research Staff, who had just been appointed to fill the gap left by the death of Malvar, our greatest scientist. Malvar's leadership had been responsible, more than any other single factor, for the efficiency and power of our weapons. His loss was a very serious blow, but no one doubted the brilliance of his successor-though many of us disputed the wisdom of appointing a theoretical scientist to fill a post of such vital importance. But we had been overruled.

I can well remember the impression Norden made at that conference. The military advisers were worried, and as usual turned to the scientists for help. Would it be possible to improve our existing weapons, they asked, so that our present advantage could be increased still further?

Norden's reply was quite unexpected. Malvar had often been asked such a question-and he had always done what we requested.

"Frankly, gentlemen," said Norden, "I doubt it. Our existing weapons have practically reached finality. I don't wish to criticize my predecessor, or the excellent work done by the Research Staff in the last few generations, but do you realize that there has been no basic change in armaments for over a century? It is, I am afraid, the result of a tradition that has become conservative. For too long, the Research Staff has devoted itself to perfecting old weapons instead of developing new ones. It is fortunate for us that our opponents have been no wiser: we cannot assume that this will always be so."

Norden's words left an uncomfortable impression, as he had no doubt intended. He quickly pressed home the attack.

"What we want are new weapons-weapons totally different from any that have been employed before. Such weapons can be made: it will take time, of course, but since assuming charge I have replaced some of the older scientists by young men and have directed, research into several unexplored fields which show great promise. I believe, in fact, that a revolution in warfare may soon be upon us."

We were skeptical. There was a bombastic tone in Norden's voice that made us suspicious of his claims. We did not know, then, that he never promised anything that he had not already almost perfected in the laboratory. In the laboratory-that was the operative phrase.

Norden proved his case less than a month later, when he demonstrated the Sphere of Annihilation, which produced complete disintegration of matter over a radius of several hundred meters. We were intoxicated by the power of the new weapon, and were quite prepared to overlook one fundamental defect-the fact that it was a sphere and hence destroyed its rather complicated generating equipment at the instant of formation. This meant, of course, that it could not be used on warships but only on guided missiles, and a great program was started to convert all homing torpedoes to carry the new weapon. For the time being all further offensives were suspended.

We realize now that this was our first mistake. I still think that it was a natural one, for it seemed to us then that all our existing weapons had become obsolete overnight, and we already regarded them as almost primitive survivals. What we did not appreciate was the magnitude of the task we were attempting, and the length of time it would take to get the revolutionary super-weapon into battle. Nothing like this had happened for a hundred years and we had no previous experience to guide us.

The conversion problem proved far more difficult than anticipated. A new class of torpedo had to be designed, as the standard model was too small. This meant in turn that only the larger ships could launch the weapon, but we were prepared to accept this penalty. After six months, the heavy units of the Fleet were being equipped with the Sphere. Training maneuvers and tests had shown that it was operating satisfactorily and we were ready to take it into

action. Norden was already being hailed as the architect of victory, and had half promised even more spectacular weapons.

Then two things happened. One of our battleships disappeared completely on a training flight, and an investigation showed that under certain conditions the ship's long-range radar could trigger the Sphere immediately it had been launched. The modification needed to overcome this defect was trivial, but it caused a delay of another month and was the source of much bad feeling between the naval staff and the scientists. We were ready for action again when Norden announced that the

radius of effectiveness of the Sphere had now been increased by ten, thus multiplying by a thousand the chances of destroying an enemy ship.

So the modifications started all over again, but everyone agreed that the delay would be worth it. Meanwhile, however, the enemy had been emboldened by the absence of further attacks and had made an unexpected onslaught. Our ships were short of torpedoes, since none had been coming from the factories, and were forced to retire. So we lost the systems of Kyrane and Floranus, and the planetary fortress of Rhamsandron.

It was an annoying but not a serious blow, for the recaptured systems had been unfriendly, and difficult to administer. We had no doubt that we could restore the position in the near future, as soon as the new weapon became operational.

These hopes were only partially fulfilled. When we renewed our offensive, we had to do so with fewer of the Spheres of Annihilation than had been planned, and this was one reason for our limited success. The other reason was more serious.

While we had been equipping as many of our ships as we could with the irresistible weapon, the enemy had been building feverishly. His ships were of the old pattern with the old weapons-but they now outnumbered ours. When we went into action, we found that the numbers ranged against us were often 100 per cent greater than expected, causing target confusion among the automatic weapons and resulting in higher losses than anticipated. The enemy losses were higher still, for once a Sphere had reached its objective, destruction was certain, but the balance had not swung as far in our favor as we had hoped.

Moreover, while the main fleets had been engaged, the enemy had launched a daring attack on the lightly held systems of Eriston,

Duranus, Carmanidora and Pharanidon-recapturing them all. We were thus faced with a threat only fifty light-years from our home planets.

There was much recrimination at the next meeting of the supreme commanders. Most of the complaints were addressed to Norden-Grand Admiral Taxaris in particular maintaining that thanks to our admittedly irresistible weapon we were now considerably worse off than before. We should, he claimed, have continued to build conventional ships, thus preventing the loss of our numerical superiority.

Norden was equally angry and called the naval staff ungrateful bunglers. But I could tell that he was worried-as indeed we all were-by the unexpected turn of events. He hinted that there might be a speedy way of remedying the situation.

We now know that Research had been working on the Battle Analyzer for many years, but at the time it came as a revelation to us and perhaps we were too easily swept off our feet. Norden's argument, also, was seductively convincing. What did it matter, he said, if the enemy had twice as many ships as we-if the efficiency of ours could be doubled or even trebled? For decades the limiting factor in warfare had been not mechanical but biological-it had become more and more difficult for any single mind, or group of minds, to cope with the rapidly changing complexities of battle in three-dimensional space. Norden's mathematicians had analyzed some of the classic engagements of the past, and had shown that even when we had been victorious we had often operated our units at much less than half of their theoretical efficiency.

The Battle Analyzer would change all this by replacing the operations staff with electronic calculators. The idea was not new, in theory, but until now it had been no more than a utopian dream. Many of us found it difficult to believe that it was still anything but a dream: after we had run through several very complex dummy battles, however, we were convinced.

It was decided to install the Analyzer in four of our heaviest ships, so that each of the main fleets could be equipped with one. At this stage, the trouble began-though we did not know it until later.

The Analyzer contained just short of a million vacuum tubes and needed a team of five hundred technicians to maintain and

operate it. It was quite impossible to accommodate the extra staff aboard a battleship, so each of the four units had to be accompanied by a converted liner to carry the technicians not on duty. Installation was also a very slow and tedious business, but by gigantic efforts it was completed in six months.

Then, to Our dismay, we were confronted by another crisis. Nearly five thousand highly skilled men had been selected to serve the Analyzers and had been given an intensive course at the Technical Training Schools. At the end of seven months, 10 per cent of them had had nervous breakdowns and only 40 per cent had qualified.

Once again, everyone started to blame everyone else. Norden, of course, said that the Research Staff could not be held responsible, and so incurred the enmity of the Personnel and Training Commands. It was finally decided that the only thing to do was to use two instead of four Analyzers and to bring the others into action as soon as men could be trained. There was little time to lose, for the enemy was still on the offensive and his morale was rising.

The first Analyzer fleet was ordered to recapture the system of Eriston. On the way, by one of the hazards of war, the liner carrying the technicians was struck by a roving mine. A warship would have survived, but the liner with its irreplaceable cargo was totally destroyed. So the operation had to be abandoned.

The other expedition was, at first, more successful. There was no doubt at all that the Analyzer fulfilled its designers' claims, and the enemy was heavily defeated in the first engagements. He withdrew, leaving us in possession of Saphran, Leucon and Hexanerax. But his Intelligence Staff must have noted the change in our tactics and the inexplicable presence of a liner in the heart of our battle_ fleet. It must have noted, also, that our first fleet had been accompanied by a similar ship-and had withdrawn when it had been destroyed.

In the next engagement, the enemy used his superior numbers to launch an overwhelming attack on the Analyzer ship and its unarmed consort. The attack was made without regard to losses both ships were, of course, very heavily protected-and it succeeded. The result was the virtual decapitation of the Fleet, since an effectual transfer to the old operational methods proved impossible. We disengaged under heavy fire, and so lost all our gains and also the

systems of Lormyia, Ismarnus, Beronis, Alphanidon and Sideneus. At this stage, Grand Admiral Taxaris expressed his disapproval of Norden by committing suicide, and I assumed supreme command.

The situation was now both serious and infuriating. With stubborn conservatism and complete lack of imagination, the enemy continued to advance with his old-fashioned and inefficient but now vastly more numerous ships. It was galling to realize that if we had only continued building,

without seeking new weapons, we would have been in a far more advantageous position. There were many acrimonious conferences at which Norden defended the scientists while everyone else blamed them for all that had happened. The difficulty was that Norden had proved every one of his claims: he had a perfect excuse for all the disasters that had occurred. And we could not now turn back-the search for an irresistible weapon must go on. At first it had been a luxury that would shorten the war. Now it was a necessity if we were to end it victoriously.

We were on the defensive, and so was Norden. He was more than ever determined to re-establish his prestige and that of the Research Staff. But we had been twice disappointed, and would not make the same mistake again. No doubt Norden's twenty thousand scientists would produce many further weapons: we would remain unimpressed.

We were wrong. The final weapon was something so fantastic that even now it seems difficult to believe that it ever, existed. Its innocent, noncommittal name-The Exponential Field-gave no hint of its real potentialities. Some of Norden's mathematicians had discovered it during a piece of entirely theoretical research into the properties of space, and to everyone's great surprise their results were found to be physically realizable.

It seems very difficult to explain the operation of the Field to the layman. According to the technical description, it "produces an exponential condition of space, so that a finite distance in normal, linear space may become infinite in pseudo-space." Norden gave an analogy which some of us found useful. It was as if one took a flat disk of rubber-representing a region of normal space-and then pulled its center out to infinity. The circumference of the disk would be unaltered-but its "diameter" would be infinite. That was the sort of thing the generator of the Field did to the space around it.

As an example, suppose that a ship carrying the generator was surrounded by a ring of hostile machines. If it switched on the Field, each of the enemy ships would think that it-and the ships on the far side of the circle-had suddenly receded into nothingness. Yet the circumference of the circle would be the same as before: only the journey to the center would be of infinite duration, for as one proceeded, distances would appear to become greater and greater as the "scale" of space altered.

it was a nightmare condition, but a very useful one. Nothing could reach a ship carrying the Field: it might be englobed by an enemy fleet yet would be as inaccessible as if it were at the other side of the Universe. Against this, of course, it could not fight back without switching off the Field, but this still left it at a very great advantage, not only in defense but in offense. For a ship fitted with the Field could approach an enemy fleet undetected and suddenly appear in its midst.

This time there seemed to be no flaws in the new weapon. Needless to say, we looked for all the possible objections before we committed ourselves again. Fortunately the equipment was fairly simple and did not require a large operating staff. After much debate, we decided to rush it into production, for we realized that time was running short and the war was going against us. We had now lost about the whole of our initial pins and enemy forces had made several raids into our own solar system.

We managed to hold off the enemy while the Fleet was reequipped and the new battle techniques were worked out. To use the Field operationally it was necessary to locate an enemy formation, set a course that would intercept it, and then switch on the generator for the calculated period of time. On releasing the Field again-if the calculations had been accurate-one would be in the enemy's

midst and could do great damage during the resulting confusion, retreating by the same route when necessary.

The first trial maneuvers proved satisfactory and the equipment seemed quite reliable. Numerous mock attacks were made and the crews became accustomed to the new technique. I was on one of the test flights and can vividly remember my impressions as the Field was switched on. The ships around us seemed to dwindle as if on the surface of an expanding bubble: in an instant they had vanished completely. So had the stars-but presently we could see

that the Galaxy was still visible as a faint band of light around the ship. The virtual radius of our pseudo-space was not really infinite but some hundred thousand light-years, and so the distance to the farthest stars of our system had not been greatly increased-though the nearest had of course totally disappeared.

These training maneuvers, however, had to be cancelled before they were complete owing to a whole flock of minor technical troubles in various pieces of equipment, notably the communications circuits. These were annoying, but not important, though it was thought best to return to Base to clear them up.

At that moment the enemy made what was obviously intended to be a decisive attack against the fortress planet of Iton at the limits of our solar system. The Fleet had to go into battle before repairs could be made.

The enemy must have believed that we had mastered the secret of invisibility-as in a sense we had. Our ships appeared suddenly out of nowhere and inflicted tremendous damage-for a while. And then something quite baffling and inexplicable happened.

I was in command of the flagship Hircania when the trouble started. We had been operating as independent units, each against assigned objectives. Our detectors observed an enemy formation at medium range and the navigating officers measured its distance with great accuracy. We set course and switched on the generator.

The Exponential Field was released at the moment when we should have been passing through the center of the enemy group. To our consternation, we emerged into normal space at a distance of many hundred miles-and when we found the enemy, he had already found us. We retreated, and tried again. This time we were so far away from the enemy that he located us first.

Obviously, something was seriously wrong. We broke communicator silence and tried to contact the other ships of the Fleet to see if they had experienced the same trouble. Once again we failed - and this time the failure was beyond all reason, for the communication equipment appeared to be working perfectly. We could only assume, fantastic though it seemed, that the rest of the Fleet had been destroyed.

I do not wish to describe the scenes when the scattered units of the Fleet struggled back to Base. Our casualties had actually been negligible, but the ships were completely demoralized. Almost all

had lost touch with one another and had found that their ranging equipment showed inexplicable errors. It was obvious that the Exponential Field was the cause of the troubles, despite the fact that they were only apparent when it was switched off.

The explanation came too late to do us any good, and Norden's final discomfiture was small consolation for the virtual loss of the war. As I have explained, the Field generators produced a

radial distortion of space, distances appearing greater and greater as one approached the center of the artificial pseudo-space. When the Field was switched off, conditions returned to normal.

But not quite. It was never possible to restore the initial state exactly. Switching the Field on and off was equivalent to an elongation and contraction of the ship carrying the generator, but there was an hysteretic effect, as it were, and the initial condition was never quite reproducible, owing to all the thousands of electrical changes and movements of mass aboard the ship while the Field was on. These asymmetries and distortions were cumulative, and though they seldom amounted to more than a fraction of one per cent, that was quite enough. It meant that the precision ranging equipment and the tuned circuits in the communication apparatus were thrown completely out of adjustment. Any single ship could never detect the change-only when it compared its equipment with that of another vessel, or tried to communicate with it, could it tell what had happened.

It is impossible to describe the resultant chaos. Not a single component of one ship could be expected with certainty to work aboard another. The very nuts and bolts were no longer interchangeable, and the supply position became quite impossible. Given time, we might even have overcome these difficulties, but the enemy ships were already attacking in thousands with weapons which now seemed centuries behind those that we had invented. Our magnificent Fleet, crippled by our own science, fought on as best it could until it was overwhelmed and forced to surrender. The ships fitted with the Field were still invulnerable, but as fighting units they were almost helpless. Every time they switched on their generators to escape from enemy attack, the permanent distortion of their equipment increased. In a month, it was all over.

This is the true story of our defeat, which I give without

prejudice to my defense before this Court. I make it, as I have said, to counteract the libels that have been circulating against the men who fought under me, and to show where the true blame for our misfortunes lay.

Finally, my request, which as the Court will now realize, I make in no frivolous manner and which I hope will therefore be granted.

The Court will be aware that the conditions under which we are housed and the constant surveillance to which we are subjected night and day are somewhat distressing. Yet I am not complaining of this: nor do I complain of the fact that shortage of accommodation has made it necessary to house us in pairs.

But I cannot be held responsible for my future actions if I am compelled any longer to share my cell with Professor Norden, late Chief of the Research Staff of my armed forces.

THE FOUNTAINS OF PARADISE

by

Arthur C. Clarke

To the still unfading memory of
LESLIE EKANAYAKE (13 July 1947 - 4 July 1977)
only perfect friend of a lifetime, in whom were uniquely combined Loyalty, Intelligence and Compassion.
When your radiant and loving spirit vanished from this world, the light went out of many lives.
NIRVANA PRAPTO BHUYAT

Politics and religion are obsolete; the time has come for science and spirituality.
Sri Jawaharlal Nehru, to the Ceylon Association for the Advancement of Science, Colombo, 15 October 1962.

Contents

Foreword

"From Paradise to Taprobane is forty leagues; there may be heard the sound of the Fountains of Paradise."

Traditional: reported by Friar Marignolli (A.D. 1335)

The country I have called Taprobane does not quite exist, but is about ninety percent congruent with the island of Ceylon (now Sri Lanka). Though the Afterword will make clear what locations, events and personalities are based on fact, the reader will not go far wrong in assuming that the more unlikely the story, the closer it is to reality.

The name "Taprobane" is now usually spoken to rhyme with "plain", but the correct classical pronunciation is "Tap-ROB-a-nee"

-as Milton, of course, well knew:

"From India and the golden Chersoness
And utmost Indian Isle Taprobane...

(Paradise Regained, Book IV)

I - THE PALACE

1. Kalidasa

The crown grew heavier with each passing year. When the Venerable Bodhidharma Mahanayake Thero had - so reluctantly! - first placed it upon his head, Prince Kalidasa was surprised by its lightness. Now, twenty years later, King Kalidasa gladly relinquished the jewel-encrusted band of gold, whenever court etiquette allowed.

There was little of that here, upon the windswept summit of the rock fortress; few envoys or petitioners sought audience on its forbidding heights. Many of those who made the journey to Yakkagala turned back at the final ascent, through the very jaws of the crouching lion, that seemed always about to spring from the face of the rock. An old king could never sit upon this heaven-aspiring throne. One day, Kalidasa might be too feeble to reach his own palace. But he doubted if that day would ever come; his many enemies would spare him the humiliations of age.

These enemies were gathering now. He glanced towards the north, as if he could already see the armies of his half-brother, returning to claim the blood-stained throne of Taprobane. But that threat was still far off, across monsoon-riven seas; although Kalidasa put more trust in his spies than his astrologers, it was comforting to know that they agreed on this.

Malgara had waited almost twenty years, making his plans and gathering the support of foreign kings. A still more patient and subtle enemy lay much nearer at hand, forever watching from the southern sky. The perfect cone of Sri Kanda, the Sacred Mountain, looked very close today, as it towered above the central plain. Since the beginning of history, it had struck awe into the heart of every man who saw it. Always, Kalidasa was aware of its brooding presence, and of the power that it symbolised.

And yet the Mahanayake Thero had no armies, no screaming war elephants tossing brazen tusks as they charged into battle. The High Priest was only an old man in an orange robe, whose sole material possessions were a begging bowl

and a palm leaf to shield him from the sun. While the lesser monks and acolytes chanted the scriptures around him, he merely sat in cross-legged silence - and somehow tampered with the destinies of kings. It was very strange...

The air was so clear today that Kalidasa could see the temple, dwarfed by distance to a tiny white arrowhead on the very summit of Sri Kanda. It did not look like any work of man, and it reminded the king of the still greater mountains he had glimpsed in his youth, when he had been half-guest, half-hostage at the court of Mahinda the Great. All the giants that guarded Mahinda's empire bore such Crests, formed of a dazzling, crystalline substance for which there was no word in the language of Taprobane. The Hindus believed that it was a kind of water, magically transformed, but Kalidasa laughed at such superstitions.

That ivory gleam was only three days' march away - one along the royal road, through forests and paddy-fields, two more up the winding stairway which he could never climb again, because at its end was the only enemy he feared, and could not conquer. Sometimes he envied the pilgrims, when he saw their torches marking a thin line of fire up the face of the mountain. The humblest beggar could greet that holy dawn and receive the blessings of the gods; the ruler of all this land could not.

But he had his consolations, if only for a little while. There, guarded by moat and rampart, lay the pools and fountains and Pleasure Gardens on which he had lavished the wealth of his kingdom. And when he was tired of these, there were the ladies of the rock-the ones of flesh and blood, whom he summoned less and less frequently-and the two hundred changeless immortals with whom he often shared his thoughts, because there were no others he could trust.

Thunder boomed along the western sky. Kalidasa turned away from the brooding menace of the mountain, towards the distant hope of rain. The monsoon was late this season; the artificial lakes that fed the island's complex irrigation system were almost empty. By this time of year he should have seen the glint of water in the mightiest of them al l- which, as he well knew, his subjects still dared to call by his father's name: Paravana Samudra, the Sea of Paravana. It had been completed only thirty years ago, after generations of toil. In happier days, young Prince Kalidasa had stood proudly beside his father, when the great sluice-gates were opened and the life-giving waters had poured out across the thirsty land. In all the kingdom there was no lovelier sight than the gently rippling mirror of that immense, man-made lake, when it reflected the domes and spires of Ranapura, City of Gold-the ancient capital which he had abandoned for his dream.

Once more the thunder rolled, but Kalidasa knew that its promise was false. Even here, on the summit of Demon Rock, the air hung still and lifeless; there were none of the sudden, random gusts that heralded the onset of the monsoon. Before the rains came at last, famine might be added to his troubles.

"Your Majesty," said the patient voice of the court Adigar, "the envoys are about to leave. They wish to pay their respects."

Ah yes, those two pale ambassadors from across the western ocean! He would be sorry to see them go, for they had brought news, in their abominable Taprobani, of many wonders-though none, they were willing to admit, that equalled this fortress-palace in the sky.

Kalidasa turned his back upon the white-capped mountain and the parched, shimmering landscape, and began to descend the granite steps to the audience chamber. Behind him, the chamberlain and his aides bore gifts of ivory and gems for the tall, proud men who were waiting to say farewell. Soon they would carry the treasures of Taprobane across the sea, to a city younger by centuries than Ranapura; and perhaps, for a little while, divert the brooding thoughts of the Emperor Hadrian.

His robes a flare of orange against the white plaster of the temple walls, the Mahanayake Thero walked slowly to the northern parapet. Far below lay the chequer-board of paddy-fields stretching from horizon to horizon, the dark lines of irrigation channels, the blue gleam of the Paravana Samudra-and, beyond that inland sea, the sacred domes of Ranapura floating like ghostly bubbles, impossibly huge when one realised their true distance. For thirty years he had watched that ever-changing panorama, but he knew that he would never grasp all the details of its fleeting complexity, colours, boundaries altered with every season - indeed, with every passing cloud. On the day that he too passed, thought Bodhidharma, he would still see something new.

Only one thing jarred in all this exquisitely patterned landscape. Tiny though it appeared from this altitude, the grey boulder of Demon Rock seemed an alien intruder. Indeed, legend had it that Yakkagala was a fragment of the herb-bearing Himalayan peak that the monkey god Hanuman had dropped, as he hastily carried both medicine and mountain to his injured comrades, when the battles of the Ramayana were over.

From this distance, of course, it was impossible to see any details of Kalidasa's folly, except for a faint line that hinted at the outer rampart of the Pleasure Gardens. Yet once it had been experienced, such was the impact of Demon Rock that it was impossible to forget. The Mahanayake Thero could see in imagination, as clearly as if he stood between them, the immense lion's claws protruding from the sheer face of the cliff - while overhead loomed the battlements upon which, it was easy to believe, the accursed King still walked.

Thunder crashed down from above, rising swiftly to such a crescendo of power that it seemed to shake the mountain itself. In a continuous, sustained concussion it raced across the sky, dwindling away into the east. For long seconds, echoes rolled around the rim of the horizon. No-one could mistake this as any herald of the coming rains; they were not scheduled for another three weeks, and Monsoon Control was never in error by more than twenty-four hours. When the reverberations had died away, the Mahanayake turned to his companion.

"So much for dedicated re-entry corridors," he said, with slightly more annoyance than an exponent of the Dharma should permit himself. "Did we get a meter reading?"

The younger monk spoke briefly into his wrist microphone, and waited for a reply.

"Yes-it peaked at a hundred and twenty. That's five db above the previous record."

"Send the usual protest to Kennedy or Gagarin Control, whichever it is. On second thoughts, complain to them both. Not that it will make any difference, of course."

As his eye traced the slowly dissolving vapour trail across the sky, Bodhidharma Mahanayake Thero - eighty-fifth of his name - had a sudden and most un-monkish fantasy. Kalidasa would have had a suitable treatment for space-line operators who thought only of dollars per kilo to orbit... something that probably involved impalement, or metal-shod elephants, or boiling oil.

But life, of course, had been so much simpler, two thousand years ago.

2. The Engineer

His friends, whose numbers dwindled sadly every year, called him Johan. The world, when it remembered him, called him Raja. His full name epitomised five hundred years of history; Johan Oliver de Alwis Sri Rajasinghe.

There had been a time when the tourists visiting the Rock bad sought him out with cameras and recorders, but now a whole generation knew nothing of the days when he was the most familiar face in the solar system. He did not regret his past glory, for it had brought him the gratitude of all mankind. But it had also brought vain regrets for the mistakes he had made - and sorrow for the lives he had squandered, when a little more foresight or patience might have saved them. Of course, it was easy now, in the perspective of history, to see what should have been done to avert the Auckland Crisis, or to assemble the unwilling signatories of the Treaty of Samarkand. To blame himself for the unavoidable errors of the past was folly, yet there were times when his conscience hurt him more than the fading twinges of that old Patagonian bullet.

No-one had believed that his retirement would last so long. "You'll be back within six months," World President Chu had told him. "Power is addictive."

"Not to me," he had answered, truthfully enough.

For power had come to him; he had never sought it. And it had always been a very special, limited kind of power - advisory, not executive. He was only Special Assistant (Acting Ambassador) for Political Affairs, directly responsible to President and Council, with a staff that never exceeded ten-eleven, if one included ARISTOTLE. (His console still had direct access to Ari's memory and processing banks, and they talked to each other several times a year.) But towards the end the Council had invariably accepted his advice, and the world had given him much of the credit that should have gone to the unsung, unhonoured bureaucrats of the Peace Division.

And so it was Ambassador-at-Large Rajasinghe who got all the publicity, as he moved from one trouble-spot to another, massaging egos here, defusing crises there, and manipulating the truth with consummate skill. Never actually lying, of course; that would have been fatal. Without Ari's infallible memory, he could never have kept control of the intricate webs he was sometimes compelled to spin, that mankind might live in peace. When he had begun to enjoy the game for its own sake, it was time to quit.

That had been twenty years ago, and he had never regretted his decision. Those who predicted that boredom would succeed where the temptations of power had failed did not know their man or understand his origins. He had gone back to the fields and forests of his youth, and was living only a kilometre from the

great, brooding rock that had dominated his childhood. Indeed, his villa was actually inside the wide moat that surrounded the Pleasure Gardens, and the fountains that Kalidasa's architect had designed now splashed in Johan's own courtyard, after a silence of two thousand years. The water still flowed in the original stone conduits; nothing had been changed, except that the cisterns high up on the rock were now filled by electric pumps, not relays of sweating slaves.

Securing this history-drenched piece of land for his retirement had given Johan more satisfaction than anything in his whole career, fulfilling a dream that he had never really believed could come true. The achievement had required all his diplomatic skills, plus some delicate blackmail in the Department of Archaeology. Later, questions had been asked in the State Assembly; but fortunately not answered.

He was insulated from all but the most determined tourists and students by an extension of the moat, and screened from their gaze by a thick wall of mutated Ashoka trees, blazing with flowers throughout the year. The trees also supported several families of monkeys, who were amusing to watch but occasionally invaded the villa and made off with any portable objects that took their fancy. Then there would be a brief inter-species war with fire-crackers and recorded danger-cries that distressed the humans at least as much as the simians - who would be back quickly enough, for they had long ago learned that no-one would really harm them.

One of Taprobane's more outrageous sunsets was transfiguring the western sky when the small electrotrike came silently through the trees, and drew up beside the granite columns of the portico. (Genuine Chola, from the late Ranapura Period-and therefore a complete anachronism here. But only Professor Sarath had ever commented on it; and he of course invariably did so.)

Through long and bitter experience, Rajasinghe had learned never to trust first impressions, but also never to ignore them. He had half-expected that, like his achievements, Vannevar Morgan would be a large, imposing man. Instead, the engineer was well below average height, and at first glance might even have been called frail. That slender body, however, was all sinew, and the raven-black hair framed a face that looked considerably younger than its fifty-one years. The video display from Ari's BIOG file had not done him justice; he should have been a romantic poet, or a concert pianist - or, perhaps, a great actor, holding thousands spell-bound by his skill. Rajasinghe knew power when he saw it, for power had been his business; and it was power that he was facing now. Beware of small men, he had often told himself - for they are the movers and shakers of the world.

And with this thought there came the first flicker of apprehension. Almost every week, old friends and old enemies came to this remote spot, to exchange news and to reminisce about the past. He welcomed such visits, for they gave a continuing pattern to his life. Yet always he knew, to a high degree of accuracy, the purpose of the meeting, and the ground that would be covered. But as far as Rajasinghe was aware, he and Morgan had no interests in common, beyond those of any men in this day and age. They had never met, or had any prior communication; indeed, he had barely recognised Morgan's name. Still more unusual was the fact that the engineer had asked him to keep this meeting confidential.

Though Rajasinghe had complied, it was with a feeling of resentment. There was no need, any more, for secrecy in his peaceful life; the very last thing he wanted now was for some important mystery to impinge upon his well-ordered

existence. He had finished with Security for ever; ten years ago - or was it even longer? - his personal guards had been removed at his own request. Yet what upset him most was not the mild secrecy, but his own total bewilderment. The Chief Engineer (Land) of the Terran Construction Corporation was not going to travel thousands of kilometres merely to ask for his autograph, or to express the usual tourist platitudes. He must have come here for some specific purpose - and, try as he might, Rajasinghe was unable to imagine it.

Even in his days as a public servant, Rajasinghe had never had occasion to deal with TCC; its three divisions - Land, Sea, Space - huge though they were, made perhaps the least news of all the World Federation's specialised bodies. Only when there was some resounding technical failure, or a head-on collision with an environmental or historical group, did TCC emerge from the shadows. The last confrontation of this kind had involved the Antarctic Pipeline - that miracle of twenty-first-century engineering, built to pump fluidised coal from the vast polar deposits to the power plants and factories of the world. In a mood of ecological euphoria, TCC had proposed demolishing the last remaining section of the pipeline and restoring the land to the penguins. Instantly there had been cries of protest from the industrial archaeologists, outraged at such vandalism, and from the naturalists, who pointed out that the penguins simply loved the abandoned pipeline. It had provided housing of a standard they had never before enjoyed, and thus contributed to a population explosion that the killer whales could barely handle. So TCC had surrendered without a fight.

Rajasinghe did not know if Morgan had been associated with this minor débacle. It hardly mattered, since his name was now linked with TCC's greatest triumph.

The Ultimate Bridge, it had been christened; and perhaps with justice. Rajasinghe had watched, with half the world, when the final section was lifted gently skywards by the Graf Zeppelin - itself one of the marvels of the age. All the airship's luxurious fittings had been removed to save weight; the famous swimming pool had been drained, and the reactors were pumping their excess heat into the gas-bags to give extra lift. It was the first time that a dead-weight of more than a thousand tons had even been hoisted three kilometres straight up into the sky, and everything - doubtless to the disappointment of millions - had gone without a hitch.

No ship would ever again pass the Pillars of Hercules without saluting the mightiest bridge that man had ever built - or, in all probability, would ever build. The twin towers at the junction of Mediterranean and Atlantic were themselves the tallest structures in the world, and faced each other across fifteen kilometres of space - empty, save for the incredible, delicate arch of the Gibraltar Bridge. It would be a privilege to meet the man who had conceived it; even though he was an hour late.

"My apologies, Ambassador," said Morgan as he climbed out of the trike. "I hope the delay hasn't inconvenienced you."

"Not at all; my time is my own. You've eaten, I hope?"

"Yes - when they cancelled my Rome connexion, at least they gave me an excellent lunch."

"Probably better than you'd get at the Hotel Yakkagala. I've arranged a room for the night - it's only a kilometre from here. I'm afraid we'll have to postpone our discussion until breakfast."

Morgan looked disappointed, but gave a shrug of acquiescence.

"Well, I've plenty of work to keep me busy. I assume that the hotel has full executive facilities - or at least a standard terminal."

Rajasinghe laughed. "I wouldn't guarantee anything much more sophisticated than a telephone. But I have a better suggestion. In just over half-an-hour, I'm taking some friends to the Rock. There's a son-et-lumière performance that I strongly recommend, and you're very welcome to join us."

He could tell that Morgan was hesitating, as he tried to think of a polite excuse.

"That's very kind of you, but I really must contact my office..." "You can use my console. I can promise you - you'll find the show fascinating, and it only lasts an hour. Oh, I'd forgotten - you don't want anyone to know you're here. Well, I'll introduce you as Doctor Smith from the University of Tasmania. I'm sure my friends won't recognise you."

Rajasinghe had no intention of offending his visitor, but there was no mistaking Morgan's brief flash of irritation. The ex-diplomat's instincts automatically came into play; he filed the reaction for future reference.

"I'm sure they won't," Morgan said, and Rajasinghe noted the unmistakable tone of bitterness in his voice. "Doctor Smith would be fine. And now - if I might use your console."

Interesting, thought Rajasinghe as he led his guest into the villa, but probably not important. Provisional hypothesis: Morgan was a frustrated, perhaps even a disappointed man. It was hard to see why, since he was one of the leaders of his profession. What more could he want? There was one obvious answer; Rajasinghe knew the symptoms well, if only because in his case the disease had long since burned itself out

"Fame is the spur," he recited in the silence of his thoughts. How did the rest of it go? "That last infirmity of noble mind... To scorn delights, and live laborious days."

Yes, that might explain the discontent his still-sensitive antennae had detected. And he suddenly recalled that the immense rainbow linking Europe and Africa was almost invariably called the Bridge occasionally the Gibraltar Bridge... but never Morgan's Bridge.

Well, Rajasinghe thought to himself, if you're looking for fame, Dr. Morgan, you won't find it here. Then why in the name of a thousand yakkas have you come to quiet little Taprobane?

3. The Fountains

For days, elephants and slaves had toiled in the cruel sun, hauling the endless chains of buckets up the face of the cliff. "Is it ready?" the King had

asked, time and again. "No, Majesty," the master craftsman had answered, "the tank is not yet full. But tomorrow, perhaps..."

Tomorrow had come at last, and now the whole court was gathered in the Pleasure Gardens, beneath awnings of brightly coloured cloth. The King himself was cooled by large fans, waved by supplicants who had bribed the chamberlain for this risky privilege. It was an honour which might lead to riches, or to death.

All eyes were on the face of the Rock, and the tiny figures moving upon its summit. A flag fluttered; far below, a horn sounded briefly. At the base of the cliff workmen frantically manipulated levers, hauled on ropes. Yet for a long time nothing happened.

A frown began to spread across the face of the King, and the whole court trembled. Even the waving fans lost momentum for a few seconds, only to speed up again as the wielders recalled the hazards of their task. Then a great shout came from the workers at the foot of Yakkagala-a cry of joy and triumph that swept steadily closer as it was taken up along the flower-lined paths. And with it came another sound, one not so loud, yet giving the impression of irresistible, pent-up forces, rushing towards their goal.

One after the other, springing from the earth as if by magic, the slim columns of water leaped towards the cloudless sky. At four times the height of a man, they burst into flowers of spray. The sunlight, breaking through them, created a rainbow-hued mist that added to the strangeness and beauty of the scene. Never, in the whole history of Taprobane, had the eyes of men witnessed such a wonder.

The King smiled, and the courtiers dared to breathe again. This time the buried pipes had not burst beneath the weight of water; unlike their luckless predecessors, the masons who had laid them had as good a chance of reaching old age as anyone who laboured for Kalidasa.

Almost as imperceptibly as the westering sun, the jets were losing altitude. Presently they were no taller than a man; the painfully filled reservoirs were nearly drained. But the King was well satisfied; he lifted his hand, and the fountains dipped and rose again as if in one last curtsey before the throne, then silently collapsed. For a little while ripples raced back and forth across the surface of the reflecting pools; then they once again became still mirrors, framing the image of the eternal Rock.

"The workmen have done well," said Kalidasa. "Give them their freedom."

How well, of course, they would never understand, for none could share the lonely visions of an artist-king. As Kalidasa surveyed the exquisitely tended gardens that surrounded Yakkagala, he felt as much contentment as he would ever know.

Here, at the foot of the Rock, he had conceived and created Paradise. It only remained, upon its summit, to build Heaven.

4. Demon Rock

This cunningly contrived pageant of light and sound still had power to move Rajasinghe, though he had seen it a dozen times and knew every trick of the programming. It was, of course, obligatory for every visitor to the Rock, though critics like Professor Sarath complained that it was merely instant history for tourists. Yet instant history was better than no history at all, and it would have to serve while Sarath and his colleagues still vociferously disagreed about the precise sequence of events here, two thousand years ago.

The little amphitheatre faced the western wall of Yakkagala, its two hundred seats all carefully orientated so that each spectator looked up into the laser projectors at the correct angle. The performance always began at exactly the same time throughout the year - 19.00 hours, as the last glow of the invariant equatorial sunset faded from the sky.

Already it was so dark that the Rock was invisible, revealing its presence only as a huge, black shadow eclipsing the early stars. Then, out of that darkness, there came the slow beating of a muffled drum; and presently a calm, dispassionate voice:

"This is the story of a king who murdered his father and was killed by his brother. In the blood-stained history of mankind, that is nothing new. But this king left an abiding monument; and a legend which has endured for centuries..."

Rajasinghe stole a glance at Vannevar Morgan, sitting there in the darkness on his right. Though he could see the engineer's features only in silhouette, he could tell that his visitor was already caught in the spell of the narration. On his left his other two guests - old friends from his diplomatic days - were equally entranced. As he had assured Morgan, they had not recognised "Dr. Smith"; or if they had indeed done so, they had politely accepted the fiction.

"His name was Kalidasa, and he was born a hundred years after Christ, in Ranapura, City of Gold - for centuries the capital of the Taprobanean kings. But there was a shadow across his birth..."

The music became louder, as flutes and strings joined the throbbing drum, to trace out a haunting, regal melody in the night air. A point of light began to burn on the face of the Rock; then, abruptly, it expanded - and suddenly it seemed that a magic window had opened into the past, to reveal a world more vivid and colourful than life itself.

The dramatisation, thought Morgan, was excellent; he was glad that, for once, he had let courtesy override his impulse to work. He saw the joy of King Paravana when his favourite concubine presented him with his first-born son - and understood how that joy was both augmented and diminished when, only twenty-four hours later, the Queen herself produced a better claimant to the throne. Though first in time, Kalidasa would not be first in precedence; and so the stage was set for tragedy.

"Yet in the early years of their boyhood Kalidasa and his half-brother Malgara were the closest of friends. They grew up together quite unconscious of their rival destinies, and the intrigues that festered around them. The first cause of trouble had nothing to do with the accident of birth; it was only a well-intentioned, innocent gift."

"To the court of King Paravana came envoys bearing tribute from many lands - silk from Cathay, gold from Hindustan, burnished armour from Imperial Rome. And one day a simple hunter from the jungle ventured into the great city, bearing a gift which he hoped would please the Royal family..."

All around him, Morgan heard a chorus of involuntary "Oohs" and "Aahs" from his unseen companions. Although he had never been very fond of animals, he had to admit that the tiny, snow-white monkey that nestled so trustingly in the arms of young Prince Kalidasa was very endearing. Out of the wrinkled little face two huge eyes stared across the centuries - and across the mysterious, yet not wholly unbridgeable, gulf between man and beast.

"According to the Chronicles, nothing like it had ever been seen before; its hair was white as milk, its eyes pink as rubies. Some thought it a good omen others an evil one, because white is the colour of death and of mourning. And their fears, alas, were well founded."

"Prince Kalidasa loved his little pet, and called it Hanuman after the valiant monkey-god of the Ramayana. The King's jeweller constructed a small golden cart, in which Hanuman would sit solemnly while he was drawn through the court, to the amusement and delight of all who watched."

"For his part, Hanuman loved Kalidasa, and would allow no-one else to handle him. He was especially jealous of Prince Malgara - almost as if he sensed the rivalry to come. And then, one unlucky day, he bit the heir to the throne."

"The bite was trifling - its consequences immense. A few days later Hanuman was poisoned - doubtless by order of the Queen. That was the end of Kalidasa's childhood; thereafter, it is said, he never loved or trusted another human being. And his friendship towards Malgara turned to bitter enmity."

"Nor was this the only trouble that stemmed from the death of one small monkey. By command of the King, a special tomb was built for Hanuman, in the shape of the traditional bell-shaped shrine or dagoba. Now this was an extraordinary thing to do, for it aroused the instant hostility of the monks. Dagobas were reserved for relics of the Buddha, and this act appeared to be one of deliberate sacrilege."

"Indeed, that may well have been its intention, for King Paravana had now come under the sway of a Hindu Swami, and was turning against the Buddhist faith. Although Prince Kalidasa was too young to be involved in this conflict, much of the monks' hatred was now directed against him. So began a feud that in the years to come was to tear the kingdom apart."

"Like many of the other tales recorded in the ancient chronicles of Taprobane, for almost two thousand years there was no proof that the story of Hanuman and young Prince Kalidasa was anything but a charming legend. Then, in 2015, a team of Harvard archaeologists discovered the foundations of a small shrine in the grounds of the old Ranapura Palace. The shrine appeared to have been deliberately destroyed, for all the brickwork of the superstructure had vanished.

"The usual relic chamber set in the foundations was empty, obviously robbed of its contents centuries ago. But the students had tools of which the old-time treasure-hunters never dreamed; their neutrino survey disclosed a second relic chamber, much deeper. The upper one was only a decoy, and it had served its purpose well. The lower chamber still held the burden of love and hate it had carried down the centuries - to its resting-place today, in the Ranapura Museum."

Morgan had always considered himself, with justification, reasonably hard-headed and unsentimental, not prone to gusts of emotion. Yet now, to his considerable embarrassment -he hoped that his companions wouldn't notice - he felt his eyes brim with sudden tears. How ridiculous, he told himself angrily, that some saccharine music and a maudlin narration could have such an impact on a sensible man! He would never have believed that the sight of a child's toy could have set him weeping.

And then he knew, in a sudden lightning flash of memory that brought back a moment more than forty years in the past, why he had been so deeply moved. He saw again his beloved kite, dipping and weaving above the Sydney park where he had spent much of his childhood. He could feel the warmth of the sun, the gentle wind on his bare back - the treacherous wind that suddenly failed, so that the kite plunged earthwards. It became snagged in the branches of the giant oak that was supposed to be older than the country itself and, foolishly, he had tugged at the string, trying to pull it free. It was his first lesson in the strength of materials, and one that he was never to forget.

The string had broken, just at the point of capture, and the kite had rolled crazily away into the summer sky, slowly losing altitude. He had rushed down to the water's edge, hoping that it would fall on land; but the wind would not listen to the prayers of a little boy.

For a long time he had stood weeping as he watched the shattered fragments, like some dismasted sailboat, drift across the great harbour and out towards the open sea, until they were lost from sight. That had been the first of those trivial tragedies that shape a man's childhood, whether he remembers them or not.

Yet what Morgan had lost then was only an inanimate toy; his tears were of frustration rather than grief. Prince Kalidasa had much deeper cause for anguish. Inside the little golden cart, which still looked as if it had come straight from the craftsman's workshop, was a bundle of tiny white bones.

Morgan missed some of the history that followed; when he had cleared his eyes a dozen years had passed, a complex family quarrel was in progress, and he was not quite sure who was murdering whom. After the armies had ceased to clash and the last dagger had fallen, Crown Prince Malgara and the Queen Mother had

fled to India, and Kalidasa had seized the throne, imprisoning his father in the process.

That the usurper had refrained from executing Paravana was not due to any filial devotion but to his belief that the old king still possessed some secret treasure, which he was saving for Malgara. As long as Kalidasa believed this, Paravana knew that he was safe; but at last he grew tired of the deception.

"I will show you my real wealth," he told his son. "Give me a chariot, and I will take you to it."

But on his last journey, unlike little Hanuman, Paravana rode in a decrepit ox-cart. The Chronicles record that it had a damaged wheel which squeaked all the way - the sort of detail that must be true, because no historian would have bothered to invent it.

To Kalidasa's surprise, his father ordered the cart to carry him to the great artificial lake that irrigated the central kingdom, the completion of which had occupied most of his reign. He walked along the edge of the huge bund and gazed at his own statue, twice life-size, that looked out across the waters.

"Farewell, old friend," he said, addressing the towering stone figure which symbolised his lost power and glory, and which held forever in its hands the stone map of this inland sea. "Protect my heritage."

Then, closely watched by Kalidasa and his guards, he descended the spillway steps, not pausing even at the edge of the lake. When he was waist deep he scooped up the water and threw it over his head, then turned towards Kalidasa with pride and triumph.

"Here, my son," he cried, waving towards the leagues of pure, life-giving water, "here - here is all my wealth!"

"Kill him!" screamed Kalidasa, mad with rage and disappointment.

And the soldiers obeyed.

So Kalidasa became the master of Taprobane, but at a price that few men would be willing to pay. For, as the Chronicles recorded, always he lived "in fear of the next world, and of his brother". Sooner or later, Malgara would return to seek his rightful throne.

For a few years, like the long line of kings before him, Kalidasa held court in Ranapura. Then, for reasons about which history is silent, he abandoned the royal capital for the isolated rock monolith of Yakkagala, forty kilometres away in the jungle. There were some who argued that he sought an impregnable fortress, safe from the vengeance of his brother. Yet in the end he spurned its protection - and, if it was merely a citadel, why was Yakkagala surrounded by immense pleasure gardens whose construction must have demanded as much labour as the walls and moat themselves? Above all, why the frescoes?

As the narrator posed this question, the entire western face of the rock materialised out of the darkness - not as it was now, but as it must have been

two thousand years ago. A band starting a hundred metres from the ground, and running the full width of the rock, had been smoothed and covered with plaster, upon which were portrayed scores of beautiful women - life-size, from the waist upwards. Some were in profile, others full-face, and all followed the same basic pattern.

Ochre-skinned, voluptuously bosomed, they were clad either in jewels alone, or in the most transparent of upper garments. Some wore towering and elaborate head-dresses - others, apparently, crowns. Many carried bowls of flowers, or held single blossoms nipped delicately between thumb and forefinger. Though about half were darker-skinned than their companions, and appeared to be hand-maidens, they were no less elaborately coifed and bejeweled.

"Once, there were more than two hundred figures. But the rains and winds of centuries have destroyed all except twenty, which were protected by an over-hanging ledge of rock..."

The image zoomed forward; one by one the last survivors of Kalidasa's dream came floating out of the darkness, to the hackneyed yet singularly appropriate music of Anitra's Dance. Defaced though they were by weather, decay and even vandals, they had lost none of their beauty down the ages. The colours were still fresh, unfaded by the light of more than half a million westering suns. Goddesses or women, they had kept alive the legend of the Rock.

"No one knows who they were, what they represented, and why they were created with such labour, in so inaccessible a spot. The favourite theory is that they were celestial beings, and that all Kalidasa's efforts here were devoted to creating a heaven on earth, with its attendant goddesses. Perhaps he believed himself a God-King, as the Pharaohs of Egypt had done; perhaps that is why he borrowed from them the image of the Sphinx, guarding the entrance to his palace."

Now the scene shifted to a distant view of the Rock, seen reflected in the small lake at its base. The water trembled, the outlines of Yakkagala wavered and dissolved. When they had reformed, the Rock was crowned by walls and battlements and spires, clinging to its entire upper surface. It was impossible to see them clearly; they remained tantalisingly out of focus, like the images in a dream.

No man would ever know what Kalidasa's aerial palace had really looked like, before it was destroyed by those who sought to extirpate his very name.

"And here he lived, for almost twenty years, awaiting the doom that he knew would come. His spies must have told him that, with the help of the kings of southern Hindustan, Malgara was patiently gathering his armies."

"And at last Malgara came. From the summit of the Rock, Kalidasa saw the invaders marching from the north. Perhaps he believed himself impregnable; but he did not put it to the test. For he left the safety of his great fortress, and rode out to meet his brother, in the neutral ground between the two armies. One would give much to know what words they spoke, at that last encounter. Some say they embraced before they parted; it may be true."

"Then the armies met, like the waves of the sea. Kalidasa was fighting on his own territory, with men who knew the land, and at first it seemed certain that victory would go to him. But then occurred another of those accidents that determine the fate of nations."

"Kalidasa's great war elephant, caparisoned with the royal banners, turned aside to avoid a patch of marshy ground. The defenders thought that the king was retreating. Their morale broke; they scattered, as the Chronicles record, like chaff from the winnowing fan."

"Kalidasa was found on the battlefield, dead by his own hand. Malgara became king. And Yakkagala was abandoned to the jungle, not to be discovered again for seventeen hundred years."

5. Through the Telescope

"My secret vice," Rajasinghe called it, with wry amusement but also with regret. It had been years since he had climbed to the summit of Yakkagala, and though he could fly there whenever he wished, that did not give the same feeling of achievement. To do it the easy way by-passed the most fascinating architectural details of the ascent; no-one could hope to understand the mind of Kalidasa without following his footsteps all the way from Pleasure Garden to aerial Palace.

But there was a substitute which could give an ageing man considerable satisfaction. Years ago he had acquired a compact and powerful twenty-centimetre telescope; through it he could roam the entire western wall of the Rock, retracing the path he had followed to the summit so many times in the past. When he peered through the binocular eyepiece, he could easily imagine that he was hanging in mid-air, close enough to the sheer granite wall to reach out and touch it.

In the late afternoon, as the rays of the westering sun reached beneath the rock overhang that protected them, Rajasinghe would visit the frescoes, and pay tribute to the ladies of the court. Though he loved them all, he had his favourites; sometimes he would talk silently to them, using the most archaic words and phrases that he knew-well aware of the fact that his oldest Taprobani lay a thousand years in their future.

It also amused him to watch the living, and to study their reactions as they scrambled up the Rock, took photographs of each other on the summit, or admired the frescoes. They could have no idea that they were accompanied by an invisible-and envious- spectator, moving effortlessly beside them like a silent ghost, and so close that he could see every expression, and every detail of their clothing. For such was the power of the telescope that, if Rajasinghe had been able to lip-read, he could have eavesdropped on the tourists' conversation.

If this was voyeurism, it was harmless enough - and his little "vice" was hardly a secret, for he was delighted to share it with visitors. The telescope provided one of the best introductions to Yakkagala, and it had often served other useful purposes. Rajasinghe had several times alerted the guards to attempted souvenir hunting, and more than one astonished tourist had been caught carving his initials on the face of the Rock.

Rajasinghe seldom used the telescope in the morning, because the sun was then on the far side of Yakkagala and little could be seen on the shadowed western face. And, as far as he could recall, he had never used it so soon after dawn, while he was still enjoying the delightful local custom of "bed-tea", introduced by the European planters three centuries ago. Yet now, as he glanced out of the wide picture-window that gave him an almost complete view of Yakkagala, he was surprised to see a tiny figure moving along the crest of the Rock, partly silhouetted against the sky. Visitors never climbed to the top so soon after dawn - the guard wouldn't even unlock the elevator to the frescoes for another hour. Idly, Rajasinghe wondered who the early bird could be.

He rolled out of bed, clambered into his bright batik sarong, and made his way, bare-bodied, out on to the verandah, and thence to the stout concrete pillar supporting the telescope. Making a mental note, for about the fiftieth time, that he really should get the instrument a new dust-cover, he swung the stubby barrel towards the Rock.

"I might have guessed it!" he told himself with considerable pleasure, as he switched to high power. So last night's show had impressed Morgan, as well it should have done. The engineer was seeing for himself, in the short time available, how Kalidasa's architects had met the challenge imposed upon them.

Then Rajasinghe noticed something quite alarming. Morgan was walking briskly around at the very edge of the plateau, only centimetres away from the sheer drop that few tourists ever dared to approach. Not many had the courage even to sit in the Elephant Throne, with their feet dangling over the abyss; but now the engineer was actually kneeling beside it, holding on to the carved stonework with one casual arm - and leaning right out into nothingness as he surveyed the rock-face below. Rajasinghe, who had never been very happy even with such familiar heights as Yakkagala's, could scarcely bear to watch.

After a few minutes of incredulous observation, he decided that Morgan must be one of those rare people who are completely unaffected by heights. Rajasinghe's memory, which was still excellent but delighted in playing tricks on him, was trying to bring something to his notice. Hadn't there once been a Frenchman who had tightroped across Niagara Falls, and even stopped in the middle to cook a meal? If the documentary evidence had not been overwhelming, Rajasinghe would never have believed such a story.

And there was something else that was relevant here - an incident that concerned Morgan himself. What could it possibly be? Morgan... Morgan... he had known virtually nothing about him until a week ago.

Yes, that was it. There had been a brief controversy that had amused the news media for a day or so, and that must have been the first time he had ever heard Morgan's name.

The Chief Designer of the proposed Gibraltar Bridge had announced a startling innovation. As all vehicles would be on automatic guidance, there was

absolutely no point in having parapets or guard rails at the edge of the roadway; eliminating them would save thousands of tons. Of course, everyone thought that this was a perfectly horrible idea; what would happen, the public demanded, if some car's guidance failed, and the vehicle headed towards the edge? The Chief Designer had the answers; unfortunately, he had rather too many.

If the guidance failed, then as everyone knew the brakes would go on automatically, and the vehicle would stop in less than a hundred metres. Only on the outermost lanes was there any possibility that a car could go over the edge; that would require a total failure of guidance, sensors and brakes, and might happen once in twenty years.

So far, so good. But then the Chief Engineer added a caveat. Perhaps he did not intend it for publication; possibly he was half-joking. But he went on to say that, if such an accident did occur, the quicker the car went over the edge without damaging his beautiful bridge, the happier he would be.

Needless to say, the Bridge was eventually built with wire deflector-cables along the outer lanes, and as far as Rajasinghe knew no-one had yet taken a high-dive into the Mediterranean. Morgan, however, appeared suicidally determined to sacrifice himself to gravity here on Yakkagala; otherwise, it was hard to account for his actions.

Now what was he doing? He was on his knees at the side of the Elephant Throne, and was holding a small rectangular box, about the shape and size of an old-fashioned book. Rajasinghe could catch only glimpses of it, and the manner in which the engineer was using it made no sense at all. Possibly it was some kind of analysis device, though he did not see why Morgan should be interested in the composition of Yakkagala.

Was he planning to build something here? Not that it would be allowed, of course, and Rajasinghe could imagine no conceivable attractions for such a site; megalomaniac kings were fortunately now in short supply. In any event, he was quite certain, from the engineer's reactions on the previous evening, that Morgan had never heard of Yakkagala before coming to Taprobane.

And then Rajasinghe, who had always prided himself on his self control in even the most dramatic and unexpected situations, gave an involuntary cry of horror. Vannevar Morgan had stepped casually backwards off the face of the cliff, out into empty space.

6. The Artist

"Bring the Persian to me," said Kalidasa, as soon as he had recovered his breath. The climb from the frescoes back to the Elephant Throne was not difficult, and it was perfectly safe now that the stairway down the sheer rock face had been enclosed with walls. But it was tiring; for how many more years, Kalidasa wondered, would he be able to make this journey unaided? Though slaves could carry him, that did not befit the dignity of a king. And it was intolerable that any eyes but his should look upon the hundred goddesses and their hundred equally beautiful attendants, who formed the retinue of his celestial court.

So from now on, night and day, there would always be a guard standing at the entrance to the stairs - the only way down from the Palace to the private heaven that Kalidasa had created. After ten years of toil, his dream was now complete. Whatever the jealous monks on their mountain-top might claim to the contrary, he was a god at last.

Despite his years in the Taprobanean sun, Firdaz was still as light-skinned as a Roman; today, as he bowed before the king, he looked even paler, and ill at ease. Kalidasa regarded him thoughtfully, then gave one of his rare smiles of approval.

"You have done well, Persian," he said. "Is there any artist in the world who could do better?"

Pride obviously strove with caution before Firdaz gave his hesitant reply.

"None that I know, Majesty."

"And have I paid you well?"

"I am quite satisfied."

That reply, thought Kalidasa, was hardly accurate; there had been continuous pleas for more money, more assistants, expensive materials that could only be obtained from distant lands. But artists could not be expected to understand economics, or to know how the royal treasury had been drained by the awesome cost of the palace and its surroundings.

"And now that your work here is finished, what do you wish?"

"I would like your Majesty's permission to return to Ishfahan, so that I may see my own people once again."

It was the answer that Kalidasa had expected, and he sincerely regretted the decision he must make. But there were too many other rulers on the long road to Persia, who would not let the master-artist of Yakkagala slip through their greedy fingers. And the painted goddesses of the western wall must remain forever unchallenged.

"There is a problem," he said flatly - and Firdaz turned yet paler, his shoulders slumping at the words. A king did not have to explain anything, but this was one artist speaking to another. "You have helped me to become a god. That news has already reached many lands. If you leave my protection, there are others who will make similar requests of you."

For a moment, the artist was silent; the only sound was the moaning of the wind, which seldom ceased to complain when it met this unexpected obstacle upon its journey. Then Firdaz said, so quietly that Kalidasa could hardly hear him: "Am I then forbidden to leave?"

"You may go, and with enough wealth for the rest of your life. But only on condition that you never work for any other prince."

"I am willing to give that promise," replied Firdaz with almost unseemly haste.

Sadly, Kalidasa shook his head. "I have learned not to trust the word of artists," he said, "especially when they are no longer within my power. So I will have to enforce that promise."

To Kalidasa's surprise, Firdaz no longer looked so uncertain; it was almost as if he had made some great decision, and was finally at ease.

"I understand," he said, drawing himself up to his full height. Then deliberately he turned his back upon the king, as though his royal master no longer existed, and stared straight into the blazing sun.

The sun, Kalidasa knew, was the god of the Persians, and those words Firdaz was murmuring must be a prayer in his language. There were worse gods to worship, and the artist was staring into that blinding disc, as if he knew it was the last thing he would ever see...

"Hold him!" cried the king.

The guards rushed swiftly forward, but they were too late. Blind though he must now have been, Firdaz moved with precision. In three steps he had reached the parapet, and vaulted over it. He made no sound in his long arc down to the gardens he had planned for so many years, nor was there any echo when the architect of Yakkagala reached the foundations of his masterwork.

Kalidasa grieved for many days, but his grief turned to rage when the Persian's last letter to Ishfahan was intercepted. Someone had warned Firdaz that he would be blinded when his work was done; and that was a damnable falsehood. He never discovered the source of the rumour, though not a few men died slowly before they proved their innocence. It saddened him that the Persian had believed such a lie; surely he should have known that a fellow artist would never have robbed him of the gift of sight.

For Kalidasa was not a cruel man, nor an ungrateful one. He would have laden Firdaz with gold or at least silver - and sent him on his way with servants to take care of him for the remainder of his life. He would never have needed to use his hands again; and after a while he would not have missed them.

7. The God-King's Palace

Vannevar Morgan had not slept well, and that was most unusual. He had always taken pride in his self-awareness, and his insight into his own drives and emotions. If he could not sleep, he wanted to know why.

Slowly, as he watched the first pre-dawn light glimmer on the ceiling of his hotel bedroom, and heard the bell-like cries of alien birds, he began to marshal his thoughts. He would never have become a senior engineer of Terran Construction if he had not planned his life to avoid surprises. Although no man could be immune to the accidents of chance and fate, he had taken all reasonable steps to safeguard his career - and, above all, his reputation. His future was as fail-safe as he could make it; even if he died suddenly, the programmes stored in his computer bank would protect his cherished dream beyond the grave.

Until yesterday he had never heard of Yakkagala; indeed, until a few weeks ago he was only vaguely aware of Taprobane itself, until the logic of his quest directed him inexorably towards the island. By now he should already have left, whereas in fact his mission had not yet begun. He did not mind the slight disruption of his schedule; what did perturb him was the feeling that he was being moved by forces beyond his understanding. Yet the sense of awe had a familiar resonance. He had experienced it before when, as a child, he had flown his lost kite in Kiribilli Park, beside the granite monoliths that had once been the piers of the long-demolished Sydney Harbour Bridge.

Those twin mountains had dominated his boyhood, and had controlled his destiny. Perhaps, in any event, he would have been an engineer; but the accident of his birthplace had determined that he would be a builder of bridges. And so he had been the first man to step from Morocco to Spain, with the angry waters of the Mediterranean three kilometres below - never dreaming, in that moment of triumph, of the far more stupendous challenge that still lay ahead.

If he succeeded in the task that confronted him, he would be famous for centuries to come. Already his mind, strength and will were being taxed to the utmost, he had no time for idle distractions. Yet he had become fascinated by the achievements of an engineer-architect two thousand years dead, belonging to a totally alien culture. And there was the mystery of Kalidasa himself; what was his purpose in building Yakkagala? The king might have been a monster, but there was something about his character which struck a chord in the secret places of Morgan's own heart.

Sunrise would be in thirty minutes; it was still two hours before his breakfast with Ambassador Rajasinghe. That would be long enough - and he might have no other opportunity.

Morgan was never one to waste time. Slacks and sweater were on in less than a minute, but the careful checking of his footwear took considerably longer. Though he had done no serious climbing for years, he always carried a pair of strong, light-weight boots; in his profession, he often found them essential. He had already closed the door of his room when he had a sudden afterthought.

For a moment he stood hesitantly in the corridor; then he smiled and shrugged his shoulders. It wouldn't do any harm, and one never knew...

Once more back in the room, Morgan unlocked his suitcase and took out a small flat box, about the size and shape of a pocket calculator. He checked the battery charge, tested the manual over-ride, then clipped it to the steel buckle of his strong synthetic waist-belt. Now he was indeed ready to enter Kalidasa's haunted kingdom, and to face whatever demons it held.

The sun rose, pouring welcome warmth upon his back as Morgan passed through the gap in the massive rampart that formed the outer defences of the fortress. Before him, spanned by a narrow stone bridge, were the still waters of the great moat, stretching in a perfectly straight line for half a kilometre on either side. A small flotilla of swans sailed hopefully towards him through the lilies, then dispersed with ruffled feathers when it was clear that he had no food to offer. On the far side of the bridge he came to a second, smaller wall and climbed the narrow flight of stairs cut through it; and there before him were the Pleasure Gardens, with the sheer face of the Rock looming beyond them.

The fountains along the axis of the gardens rose and fell together with a languid rhythm, as if they were breathing slowly in unison. There was not

another human being in sight; he had the whole expanse of Yakkagala to himself. The fortress-city could hardly have been lonelier even during the seventeen hundred years when the jungle had overwhelmed it, between the death of Kalidasa and its re-discovery by nineteenth-century archaeologists.

Morgan walked past the line of fountains, feeling their spray against his skin, and stopped once to admire the beautifully carved stone guttering - obviously original - which carried the overflow. He wondered how the old-time hydraulic engineers lifted the water to drive the fountains, and what pressure differences they could handle; these soaring, vertical jets must have been truly astonishing to those who first witnessed them.

And now ahead was a steep flight of granite steps, their treads so uncomfortably narrow that they could barely accommodate Morgan's boots. Did the people who built this extraordinary place really have such tiny feet, he wondered? Or was it a clever ruse of the architect, to discourage unfriendly visitors? It would certainly be difficult for soldiers to charge up this sixty-degree slope, on steps that seemed to have been made for midgets.

A small platform, then another identical flight of steps, and Morgan found himself on a long, slowly ascending gallery cut into the lower flanks of the Rock. He was now more than fifty metres above the surrounding plain, but the view was completely blocked by a high wall coated with smooth, yellow plaster. The rock above him overhung so much that he might almost have been walking along a tunnel, for only a narrow band of sky was visible overhead.

The plaster of the wall looked completely new and unworn; it was almost impossible to believe that the masons had left their work two thousand years ago. Here and there, however, the gleaming, mirror-flat surface was scarred with scratched messages, where visitors had made their usual bids for immortality. Very few of the inscriptions were in alphabets that Morgan could recognise, and the latest date he noticed was 1931; thereafter, presumably, the Department of Archaeology had intervened to prevent such vandalism. Most of the graffiti were in flowing, rounded Taprobani; Morgan recalled from the previous night's entertainment that many were poems, dating back to the second and third century. For a little while after the death of Kalidasa, Yakkagala had known its first brief spell as a tourist attraction, thanks to the still lingering legends of the accursed king.

Halfway along the stone gallery, Morgan came to the now locked door of the little elevator leading to the famous frescoes, twenty metres directly above. He craned his head to see them, but they were obscured by the platform of the visitors' viewing cage, clinging like a metal bird's-nest to the outward-leaning face of the rock. Some tourists, Rajasinghe had told him, took one look at the dizzy location of the frescoes, and decided to satisfy themselves with photographs.

Now, for the first time, Morgan could appreciate one of the chief mysteries of Yakkagala. It was not how the frescoes were painted - a scaffolding of bamboo could have taken care of that problem - but why. Once they were completed, no-one could ever have seen them properly; from the gallery immediately beneath, they were hopelessly foreshortened - and from the base of the Rock they would have been no more than tiny, unrecognisable patches of colour. Perhaps, as some had suggested, they were of purely religious or magical significance - like those Stone Age paintings found in the depths of almost inaccessible caves.

The frescoes would have to wait until the attendant arrived and unlocked the elevator. There were plenty of other things to see; he was still only a third of the way to the summit, and the gallery was still slowly ascending, as it clung to the face of the Rock.

The high, yellow-plastered wall gave way to a low parapet, and Morgan could once more see the surrounding countryside. There below him lay the whole expanse of the Pleasure Gardens, and for the first time he could appreciate not only their huge scale (was Versailles larger?) but also their skilful planning, and the way in which the moat and outer ramparts protected them from the forest beyond.

No-one knew what trees and shrubs and flowers had grown here in Kalidasa's day, but the pattern of artificial lakes, canals, pathways and fountains was still exactly as he had left it. As he looked down on those dancing jets of water, Morgan suddenly remembered a quotation from the previous night's commentary:

"From Taprobane to Paradise is forty leagues; there may be heard the sound of the fountains of paradise."

He savoured the phrase in his mind; the Fountains of Paradise. Was Kalidasa trying to create, here on earth, a garden fit for the gods, in order to establish his claim to divinity? If so, it was no wonder that the priests had accused him of blasphemy, and placed a curse upon all his work.

At last the long gallery, which had skirted the entire western face of the Rock, ended in another steeply rising stairway - though this time the steps were much more generous in size. But the palace was still far above, for the stairs ended on a large plateau, obviously artificial. Here was all that was left of the gigantic, leonine monster who had once dominated the landscape, and struck terror into the hearts of everyone who looked upon it. For springing from the face of the rock were the paws of a gigantic, crouching beast; the claws alone were half the height of a man.

Nothing else remained, save yet another granite stairway rising up through the piles of rubble that must once have formed the head of the creature. Even in ruin the concept was awe-inspiring: anyone who dared to approach the king's ultimate stronghold had first to walk through gaping jaws.

The final ascent up the sheer - indeed, slightly over-hanging - face of the cliff was by a series of iron ladders, with guard-rails to reassure nervous climbers. But the real danger here, Morgan had been warned, was not vertigo. Swarms of normally placid hornets occupied small caves in the rock, and visitors who made too much noise had sometimes disturbed them, with fatal results.

Two thousand years ago, this northern face of Yakkagala had been covered with walls and battlements to provide a fitting background to the Taprobanean sphinx, and behind those walls there must have been stairways that gave easy access to the summit. Now time, weather, and the vengeful hand of man had swept everything away. There was only the bare rock, grooved with myriads of horizontal slots and narrow ledges that had once supported the foundations of vanished masonry.

Abruptly, the climb was over. Morgan found himself standing on a small island floating two hundred metres above a landscape of trees and fields that was flat in all directions except southwards, where the central mountains broke up the horizon. He was completely isolated from the rest of the world, yet felt master of all he surveyed; not since he had stood among the clouds, straddling Europe, and Africa, had he known such a moment of aerial ecstasy. This was indeed the residence of a God-King, and the ruins of his palace were all round.

A baffling maze of broken walls - none more than waist high - piles of weathered brick and granite-paved pathways covered the entire surface of the plateau, right to the precipitous edge. Morgan could also see a large cistern cut deeply into the solid rock - presumably a water-storage tank. As long as supplies were available, a handful of determined men could have held this place forever; but if Yakkagala had indeed been intended as a fortress, its defences had never been put to the test. Kalidasa's fateful last meeting with his brother had taken place far beyond the outer ramparts.

Almost forgetting time, Morgan roamed among the foundations of the palace that had once crowned the Rock. He tried to enter the mind of the architect, from what he could see of his surviving handiwork; why was there a pathway here? - did this truncated flight of steps lead to an upper floor? - if this coffin-shaped recess in the stone was a bath, how was the water supplied and how did it drain away? His research was so fascinating that he was quite oblivious of the increasing heat of the sun, striking down from a cloudless sky.

Far below, the emerald-green landscape was waking into life. Like brightly-coloured beetles, a swarm of little robot tractors was heading towards the rice-fields. Improbable though it seemed, a helpful elephant was pushing an overturned bus back on to the road, which it had obviously left while cornering at too high a speed; Morgan could even hear the shrill voice of the rider, perched just behind the enormous ears. And a stream of tourists was pouring like army ants through the Pleasure Gardens from the general direction of the Hotel Yakkagala; he would not enjoy his solitude much longer.

Still, he had virtually completed his exploration of the ruins - though one could, of course, spend a life-time investigating them in detail. He was happy to rest for a while, on a beautifully-carved granite bench at the very edge of the two-hundred-metre drop, overlooking the entire southern sky.

Morgan let his eyes scan the distant line of mountains, still partly concealed by a blue haze which the morning sun had not yet dispersed. As he examined it idly, he suddenly realised that what he had assumed to be a part of the cloudscape was nothing of the sort. That misty cone was no ephemeral construct of wind and vapour; there was no mistaking its perfect symmetry, as it towered above its lesser brethren.

For a moment, the shock of recognition emptied his mind of everything except wonder - and an almost superstitious awe. He had not realised that one could see the Sacred Mountain so clearly from Yakkagala. But there it was, slowly emerging from the shadow of night, preparing to face a new day; and, if he succeeded, a new future.

He knew all its dimensions, all its geology; he had mapped it through stereo-photographs and had scanned it from satellites. But to see it for the first time, with his own eyes, made it suddenly real; until now, everything had been theory. And sometimes not even that; more than once, in the small grey

hours before dawn, Morgan had woken from nightmares in which his whole project had appeared as some preposterous fantasy, which far from bringing him fame would make him the laughing-stock of the world. "Morgan's Folly", some of his peers had once dubbed the Bridge; what would they call his latest dream?

But man-made obstacles had never stopped him before. Nature was his real antagonist-the friendly enemy who never cheated and always played fair, yet never failed to take advantage of the tiniest oversight or omission. And all the forces of Nature were epitomised for him now in the distant blue cone which he knew so well, but had yet to feel beneath his feet.

As Kalidasa had done so often from this very spot, Morgan stared across the fertile green plain, measuring the challenge and considering his strategy. To Kalidasa, Sri Kanda represented both the power of the priesthood and the power of the gods, conspiring together against him. Now the gods were gone; but the priests remained. They represented something that Morgan did not understand, and would therefore treat with wary respect.

It was time to descend; he must not be late again, especially through his own miscalculation. As he rose from the stone slab on which he had been sitting, a thought that had been worrying him for several minutes finally rose to consciousness. It was strange to have placed so ornate a seat, with its beautifully carved supporting elephants, at the very edge of a precipice.

Morgan could never resist such an intellectual challenge. Leaning out over the abyss, he once again tried to attune his engineer's mind to that of a colleague two thousand years dead.

8. Malgara

Not even his closest comrades could read the expression on Prince Malgara's face when, for the last time, he gazed upon the brother who had shared his boyhood. The battlefield was quiet now; even the cries of the injured had been silenced by healing herb or yet more potent sword.

After a long while, the prince turned to the yellow-robed figure standing by his side. "You crowned him, Venerable Bodhidharma. Now you can do him one more service. See that he receives the honours of a king."

For a moment, the prelate did not reply. Then he answered softly. "He destroyed our temples and scattered the priests. If he worshipped any god, it was Siva."

Malgara bared his teeth in the fierce smile that the Mahanayake was to know all too well in the years that were left to him.

"Revered sire," said the prince, in a voice that dripped venom, "he was the first-born of Paravana the Great, he sat on the throne of Taprobane, and the evil that he did dies with him. When the body is burned, you will see that the relics are properly entombed, before you dare set foot upon Sri Kanda again."

The Mahanayake Thero bowed, ever so slightly. "It shall be done - according to your wishes."

"And there is another thing," said Malgara, speaking now to his aides. "The fame of Kalidasa's fountains reached us even in Hindustan. We would see them once, before we march on Ranapura..."

From the heart of the Pleasure Gardens which had given him such delight, the smoke of Kalidasa's funeral pyre rose into the cloudless sky, disturbing the birds of prey who had gathered from far and wide. Grimly content, though sometimes haunted by sudden memories, Malgara watched the symbol of his triumph spiralling upwards, announcing to all the land that the new reign had begun.

As if in continuation of their ancient rivalry, the water of the fountains challenged the fire, leaping skyward before it fell back to shatter the surface of the reflecting pool. But presently, long before the flames had finished their work, the reservoirs began to fail, and the jets collapsed in watery ruin. Before they rose again in the gardens of Kalidasa, Imperial Rome would have passed away, the armies of Islam would have marched across Africa, Copernicus would have dethroned the earth from the centre of the universe, the Declaration of Independence would have been signed, and men would have walked upon the Moon.

Malgara waited until the pyre had disintegrated in a final brief flurry of sparks. As the last smoke drifted against the towering face of Yakkagala, he raised his eyes towards the palace on its summit, and stared for a long time in silent appraisal.

"No man should challenge the gods," he said at last. "Let it be destroyed."

9. Filament

"You nearly gave me a heart attack," said Rajasinghe accusingly, as he poured the morning coffee. "At first I thought you had some anti-gravity device - but even I know that's impossible. How did you do it?"

"My apologies," Morgan answered with a smile. "If I'd known you were watching, I'd have warned you - though the whole exercise was entirely unplanned. I'd merely intended to take a scramble over the Rock, but then I got intrigued by that stone bench. I wondered why it was on the very edge of the cliff and started to explore."

"There's no mystery about it. At one time there was a floor - probably wood - extending outwards, and a flight of steps leading down to the frescoes from the summit. You can still see the grooves where it was keyed into the rock-face."

"So I discovered," said Morgan a little ruefully. "I might have guessed that someone would have found that out already."

Two hundred and fifty years ago, thought Rajasinghe. That crazy and energetic Englishman Arnold Lethbridge, Taprobane's first Director of Archaeology. He had himself lowered down the face of the Rock, exactly as you did. Well, not exactly...

Morgan had now produced the metal box that had allowed him to perform his miracle. Its only features were a few press-buttons, and a small readout panel; it looked for all the world like some form of simple communications device.

"This is it," he said proudly. "Since you saw me make a hundred-metre vertical walk, you must have a very good idea how it operates."

"Commonsense gave me one answer, but even my excellent telescope didn't confirm it. I could have sworn there was absolutely nothing supporting you."

"That wasn't the demonstration I'd intended, but it must have been effective. Now for my standard sales-pitch-please hook your finger through this ring."

Rajasinghe hesitated; Morgan was holding the small metal torus - about twice the size of an ordinary wedding-ring - almost as if it was electrified.

"Will it give me a shock?" he asked.

"Not a shock - but perhaps a surprise. Try to pull it away from me."

Rather gingerly, Rajasinghe took hold of the ring - then almost dropped it. For it seemed alive; it was straining towards Morgan - or, rather, towards the box that the engineer was holding in his hand. Then the box gave a slight whirring noise, and Rajasinghe felt his finger being dragged forward by some mysterious force. Magnetism? he asked himself. Of course not; no magnets could behave in this fashion. His tentative but improbable theory was correct; indeed, there was really no alternative explanation. They were engaged in a perfectly straightforward tug-of-war - but with an invisible rope.

Though Rajasinghe strained his eyes, he could see no trace of any thread or wire connecting the ring through which his finger was hooked and the box which Morgan was operating like a fisherman reeling in his catch. He reached out his free hand to explore the apparently empty space, but the engineer quickly knocked it away.

"Sorry!" he said. "Everyone tries that, when they realise what's happening. You could cut yourself very badly."

"So you do have an invisible wire. Clever - but what use is it, except for parlour tricks?"

Morgan gave a broad smile. "I can't blame you for jumping to that conclusion; it's the usual reaction. But it's quite wrong; the reason you can't see this sample is that it's only a few microns thick. Much thinner than a spider's web."

For once, thought Rajasinghe, an overworked adjective was fully justified. "That's - incredible. What is it?"

"The result of about two hundred years of solid state physics. For whatever good that does - it's a continuous pseudo-one-dimensional diamond crystal - though it's not actually pure carbon. There are several trace elements, in carefully controlled amounts. It can only be mass-produced in the orbiting factories, where there's no gravity to interfere with the growth process."

"Fascinating," whispered Rajasinghe, almost to himself. He gave little tugs on the ring hooked around his finger, to test that the tension was still there and that he was not hallucinating. "I can appreciate that this may have all sorts of technical applications. It would make a splendid cheese-cutter-"

Morgan laughed. "One man can bring a tree down with it, in a couple of minutes. But it's tricky to handle - even dangerous. We've had to design special dispensers to spool and unspool it - we call them 'spinnerettes'. This is a power-operated one, made for demonstration purposes. The motor can lift a couple of hundred kilos, and I'm always finding new uses for it. Today's little exploit wasn't the first, by any means."

Almost reluctantly, Rajasinghe unhooked his finger from the ring. It started to fall, then began to pendulum back and forth without visible means of support until Morgan pressed a button and the spinnerette reeled it in with a gentle whirr.

"You haven't come all this way, Dr. Morgan, just to impress me with this latest marvel of science - though I am impressed. I want to know what all this has to do with me."

"A very great deal, Mister Ambassador," answered the engineer, suddenly equally serious and formal. "You are quite correct in thinking that this material will have many applications, some of which we are only now beginning to foresee. And one of them, for better or for worse, is going to make your quiet little island the centre of the world. No - not merely the world. The whole Solar System. Thanks to this filament, Taprobane will be the steppingstone to all the planets. And one day, perhaps - the stars."

10. The Ultimate Bridge

Paul and Maxine were two of his best and oldest friends, yet until this moment they had never met nor, as far as Rajasinghe knew, even communicated. There was little reason why they should; no-one outside Taprobane had ever heard of Professor Sarath, but the whole Solar System would instantly recognise Maxine Duval, either by sight or by sound.

His two guests were reclining in the library's comfortable lounge chairs, while Rajasinghe sat at the villa's main console. They were all staring at the fourth figure, who was standing motionless.

Too motionless. A visitor from the past, knowing nothing of the everyday electronic miracles of this age, might have decided after a few seconds that he was looking at a superbly detailed wax dummy. However, more careful examination would have revealed two disconcerting facts. The "dummy" was transparent enough for highlights to be clearly visible through it; and its feet blurred out of focus a few centimetres above the carpet.

"Do you recognise this man?" Rajasinghe asked.

"I've never seen him in my life," Sarath replied instantly. "He'd better be important, for you to have dragged me back from Maharamba. We were just about to open the Relic Chamber."

"I had to leave my trimaran at the beginning of the Lake Saladin races," said Maxine Duval, her famous contralto voice containing just enough annoyance to put anyone less thick-skinned than Professor Sarath neatly in his place. "And I know him, of course. Does he want to build a bridge from Taprobane to Hindustan?"

Rajasinghe laughed. "No - we've had a perfectly serviceable causeway for two centuries. And I'm sorry to have dragged you both here - though you, Maxine, have been promising to come for twenty years."

"True," she sighed. "But I have to spend so much time in my studio that I sometimes forget there's a real world out there, occupied by about five thousand dear friends and fifty million intimate acquaintances."

"In which category would you put Dr. Morgan?"

"I've met him - oh, three or four times. We did a special interview when the Bridge was completed. He's a very impressive character."

Coming from Maxine Duval, thought Rajasinghe, that was tribute indeed. For more than thirty years she had been perhaps the most respected member of her exacting profession, and had won every honour that it could offer. The Pulitzer Prize, the Global Times Trophy, the David Frost Award - these were merely the tip of the iceberg. And she had only recently returned to active work after two years as Walter Cronkite Professor of Electronic Journalism at Columbia.

All this had mellowed her, though it had not slowed her down. She was no longer the sometimes fiery chauvinist who had once remarked: "Since women are better at producing babies, presumably Nature has given men some talent to compensate. But for the moment I can't think of it." However, she had only recently embarrassed a hapless panel chairman with the loud aside: "I'm a newswoman, dammit - not a newsperson."

Of her femininity there had never been any doubt; she had been married four times, and her choice of REMS was famous. Whatever their sex, Remotes were always young and athletic, so that they could move swiftly despite the encumbrance of up to twenty kilos of communications gear. Maxine Duval's were invariably very male and very handsome; it was an old joke in the trade that all her REMs were also RAMS. The jest was completely without rancour, for even her fiercest professional rivals liked Maxine almost as much as they envied her.

"Sorry about the race," said Rajasinghe, "but I note that Marlin III won very handily without you. I think you'll admit that this is rather more important... But let Morgan speak for himself."

He released the PAUSE button on the projector, and the frozen statue came instantly to life.

"My name is Vannevar Morgan. I am Chief Engineer of Terran Construction's Land Division. My last project was the Gibraltar Bridge. Now I want to talk about something incomparably more ambitious."

Rajasinghe glanced round the room. Morgan had hooked them, just as he had expected.

He leaned back in his chair, and waited for the now familiar, yet still almost unbelievable, prospectus to unfold. Odd, he told himself, how quickly one accepted the conventions of the display, and ignored quite large errors of the Tilt and Level controls. Even the fact that Morgan "moved" while staying in the same place, and the totally false perspective of exterior scenes, failed to destroy the sense of reality.

"The Space Age is almost two hundred years old. For more than half that time, our civilisation has been utterly dependent upon the host of satellites that now orbit Earth. Global communications, weather forecasting and control, land and ocean resources banks, postal and information services - if anything happened to their space-borne systems, we would sink back into a dark age. During the resultant chaos, disease and starvation would destroy much of the human race.

"And looking beyond the Earth, now that we have self-sustaining colonies on Mars, Mercury and the Moon, and are mining the incalculable wealth of the asteroids, we see the beginnings of true interplanetary commerce. Though it took a little longer than the optimists predicted, it is now obvious that the conquest of the air was indeed only a modest prelude to the conquest of space.

"But now we are faced with a fundamental problem - an obstacle that stands in the way of all future progress. Although generations of research have made the rocket the most reliable form of propulsion ever invented -"

("Has he considered bicycles?" muttered Sarath.)

"- space vehicles are still grossly inefficient. Even worse, their effect on the environment is appalling. Despite all attempts to control approach corridors, the noise of take-off and re-entry disturbs millions of people. Exhaust products dumped in the upper atmosphere have triggered climatic changes, which may have very serious results. Everyone remembers the skin-cancer crisis of the twenties, caused by ultra-violet break-through - and the astronomical cost of the chemicals needed to restore the ozonosphere.

"Yet if we project traffic growth to the end of the century, we find that Earth-to-orbit tonnage must be increased almost fifty percent. This cannot be achieved without intolerable costs to our way of life - perhaps to our very existence. And there is nothing that the rocket engineers can do; they have almost reached the absolute limits of performance, set by the laws of physics.

"What is the alternative? For centuries, men have dreamed of anti-gravity or of 'spacedrives'. No-one has ever found the slightest hint that such things are possible; today we believe that they are only fantasy. And yet, in the very decade that the first satellite was launched, one daring Russian engineer conceived a system that would make the rocket obsolete. It was years before anyone took Yuri Artsutanov seriously. It has taken two centuries for our technology to match his vision."

Each time he played the recording, it seemed to Rajasinghe that Morgan really came alive at this point. It was easy to see why; now he was on his own territory, no longer relaying information from an alien field of expertise. And despite all his reservations and fears, Rajasinghe could not help sharing some of that enthusiasm. It was a quality which, nowadays, seldom impinged upon his life.

"Go out of doors any clear night," continued Morgan, "and you will see that commonplace wonder of our age - the stars that never rise or set, but are fixed motionless in the sky. We - and our parents - and their parents - have long taken for granted the synchronous satellites and space stations, which move above the equator at the same speed as the turning earth, and so hang forever above the same spot.

"The question Artsutanov asked himself had the childlike brilliance of true genius. A merely clever man could never have thought of it - or would have dismissed it instantly as absurd.

"If the laws of celestial mechanics make it possible for an object to stay fixed in the sky, might it not be possible to lower a cable down to the surface - and so to establish an elevator system linking Earth to space?

"There was nothing wrong with the theory, but the practical problems were enormous. Calculations showed that no existing materials would be strong enough; the finest steel would snap under its own weight long before it could span the thirty-six thousand kilometres between Earth and synchronous orbit.

"However, even the best steels were nowhere near the theoretical limits of strength. On a microscopic scale, materials had been created in the laboratory with far greater breaking strength. If they could be mass-produced, Artsutanov's dream could become reality, and the economics of space transportation would be utterly transformed.

"Before the end of the twentieth century, super-strength materials - hyperfilaments - had begun to emerge from the laboratory. But they were extremely expensive, costing many times their weight in gold. Millions of tons would be needed to build a system that could carry all Earth's outbound traffic; so the dream remained a dream.

"Until a few months ago. Now the deep-space factories can manufacture virtually unlimited quantities of hyperfilament. At last we can build the Space Elevator or the Orbital Tower, as I prefer to call it. For in a sense it is a tower, rising clear through the atmosphere, and far, far beyond..."

Morgan faded out, like a ghost that had been suddenly exorcised. He was replaced by a football-sized Earth, slowly revolving. Moving an arm's-breadth above it, and keeping always poised above the same spot on the equator, a flashing star marked the location of a synchronous satellite.

From the star, two thin lines of light started to extend-one directly down towards the earth, the other in exactly the opposite direction, out into space.

"When you build a bridge," continued Morgan's disembodied voice, "you start from the two ends and meet in the middle. With the orbital tower, it's the exact opposite. You have to build upwards and downwards simultaneously from the synchronous satellite, according to a careful programme. The trick is to keep the structure's centre of gravity always balanced at the stationary point; if you don't, it will move into the wrong orbit, and start drifting slowly round the earth."

The descending line of light reached the equator; at the same moment, the outward extension also ceased.

"The total height must be at least forty thousand kilometres - and the lowest hundred, going down through the atmosphere, may be the most critical part, for there the tower may be subject to hurricanes. It won't be stable until it's securely anchored to the ground.

"And then, for the first time in history, we shall have a stairway to heaven - a bridge to the stars. A simple elevator system, driven by cheap electricity, will replace the noisy and expensive rocket, which will then be used only for its proper job of deep-space transport. Here's one possible design for the orbital tower -"

The image of the turning earth vanished as the camera swooped down towards the tower, and passed through the walls to reveal the structure's cross-section.

"You'll see that it consists of four identical tubes - two for Up traffic, two for Down. Think of it as a four-track vertical subway or railroad, from Earth to synchronous orbit.

"Capsules for passengers, freight, fuel would ride up and down the tubes at several thousand kilometres an hour. Fusion power stations at intervals would provide all the energy needed; as ninety percent of it would be recovered, the net cost per passenger would be only a few dollars. For as the capsules fall earthwards again, their motors will act as magnetic brakes, generating electricity. Unlike re-entering spacecraft, they won't waste all their energy heating up the atmosphere and making sonic booms; it will be pumped back into the system. You could say that the Down trains will power the Up ones; so even at the most conservative estimate, the elevator will be a hundred times more efficient than any rocket.

"And there's virtually no limit to the traffic it could handle, for additional tubes could be added as required. If the time ever comes when a million people a day wish to visit Earth or to leave it - the orbital tower could cope with them. After all, the subways of our great cities once did as much..."

Rajasinghe touched a button, silencing Morgan in mid-sentence.

"The rest is rather technical - he goes on to explain how the tower can act as a cosmic sling, and send payloads whipping off to the moon and planets without the use of any rocket power at all. But I think you've seen enough to get the general idea."

"My mind is suitably boggled," said Professor Sarath. "But what on earth or off it - has all this to do with me? Or with you, for that matter?"

"Everything in due time, Paul. Any comments, Maxine?"

"Perhaps I may yet forgive you; this could be one of the stories of the decade - or the century. But why the hurry - not to mention the secrecy?"

"There's a lot going on that I don't understand, which is where you can help me. I suspect that Morgan's fighting a battle on several fronts; he's planning an announcement in the very near future, but doesn't want to act until he's quite sure of his ground. He gave me that presentation on the understanding that it wouldn't be sent over public circuits. That's why I had to ask you here."

"Does he know about this meeting?"

"Of course; indeed, he was quite happy when I said I wanted to talk to you, Maxine. Obviously, he trusts you and would like you as an ally. And as for you, Paul, I assured him that you could keep a secret for up to six days without apoplexy."

"Only if there's a very good reason for it."

"I begin to see light," said Maxine Duval. "Several things have been puzzling me, and now they're starting to make sense. First of all, this is a space project; Morgan is Chief Engineer, Land."

"So?"

"Yhu should ask, Johan! Think of the bureaucratic in-fighting, when the rocket designers and the aerospace industry get to hear about this! Trillion dollar empires will be at stake, just to start with. If he's not very careful, Morgan will be told 'Thank you very much - now we'll take over. Nice knowing you.'"

"I can appreciate that, but he has a very good case. After all, the Orbital Tower is a building - not a vehicle."

"Not when the lawyers get hold of it, it won't be. There aren't many buildings whose upper floors are moving at ten kilometres a second, or whatever it is, faster than the basement."

"You may have a point. Incidentally, when I showed signs of vertigo at the idea of a tower going a good part of the way to the moon, Dr. Morgan said, 'Then don't think of it as a tower going up - think of it as a bridge going out'. I'm still trying, without much success."

"Oh!" said Maxine Duval suddenly. "That's another piece of your jig-saw puzzle. The Bridge."

"What do you mean?"

"Did you know that Terran Construction's Chairman, that pompous ass Senator Collins, wanted to get the Gibraltar Bridge named after him?"

"I didn't; that explains several things. But I rather like Collins - the few times we've met, I found him very pleasant, and very bright. Didn't he do some first-rate geothermal engineering in his time?"

"That was a thousand years ago. And you aren't any threat to his reputation; he can be nice to you."

"How was the Bridge saved from its fate?"

"There was a small palace revolution among Terran's senior engineering staff. Dr. Morgan, of course, was in no way involved."

"So that's why he's keeping his cards close to his chest! I'm beginning to admire him more and more. But now he's come up against an obstacle he doesn't

know how to handle. He only discovered it a few days ago, and it's stopped him dead in his tracks."

"Let me go on guessing," said Maxine. "It's good practice - helps me to keep ahead of the pack. I can see why he's here. The earth-end of the system has to be on the equator, otherwise it can't be vertical. It would be like that tower they used to have in Pisa, before it fell over."

"I don't see..." said Professor Sarath, waving his arms vaguely up and down. "Oh, of course..." His voice trailed away into a thoughtful silence.

"Now," continued Maxine, "there are only a limited number of possible sites on the equator - it's mostly ocean, isn't it? - and Taprobane's obviously one of them. Though I don't see what particular advantages it has over Africa or South America. Or is Morgan covering all his bets?"

"As usual, my dear Maxine, your powers of deduction are phenomenal. You're on the right line - but you won't get any further. Though Morgan's done his best to explain the problem to me, I don't pretend to understand all the scientific details. Anyway, it turns out that Africa and South America are not suitable for the space elevator. It's something to do with unstable points in the earth's gravitational field. Only Taprobane will do - worse still, only one spot in Taprobane. And that, Paul, is where you come into the picture."

"Mamada?" yelped Professor Sarath, indignantly reverting to Taprobani in his surprise.

"Yes, you. To his great annoyance, Dr. Morgan has just discovered that the one site he must have is already occupied - to put it mildly. He wants my advice on dislodging your good friend Buddy."

Now it was Maxine's turn to be baffled. "Who?" she queried.

Sarath answered at once. "The Venerable Anandatissa Bodhidharma Mahanayake Thero, incumbent of the Sri Kanda temple," he intoned, almost as if chanting a litany. "So that's what it's all about."

There was silence for a moment; then a look of pure mischievous delight appeared on the face of Paul Sarath, Emeritus Professor of Archaeology of the University of Taprobane.

"I've always wanted," he said dreamily, "to know exactly what would happen when an irresistible force meets an immovable object."

11. The Silent Princess

When his visitors had left, in a very thoughtful mood Rajasinghe depolarised the library windows and sat for a long time staring out at the trees around the villa, and the rock walls of Yakkagala looming beyond. He had not moved when, precisely on the stroke of four, the arrival of his afternoon tea jolted him out of his reverie.

"Rani," he said, "ask Dravindra to get out my heavy shoes, if he can find them. I'm going up the Rock."

Rani pretended to drop the tray in astonishment.

"Ayo, Mahathaya!" she keened in mock distress. "You must be mad! Remember what Doctor McPherson told you -"

"That Scots quack always reads my cardiogram backwards. Anyway, my dear, what have I got to live for, when you and Dravindra leave me?"

He spoke not entirely in jest, and was instantly ashamed of his self-pity. For Rani detected it, and the tears started in her eyes.

She turned away, so that he could not see her emotion, and said in English: "I did offer to stay - at least for Dravindra's first year..."

"I know you did, and I wouldn't dream of it. Unless Berkeley's changed since I last saw it, he'll need you there. (Yet no more than I, though in different ways, he added silently to himself.) And whether you take your own degree or not, you can't start training too early to be a college president's wife."

Rani smiled. "I'm not sure that's a fate I'd welcome, from some of the horrid examples I've seen." She switched back to Taprobani. "You aren't really serious, are you?"

"Quite serious. Not to the top, of course only the frescoes. It's five years since I visited them. If I leave it much longer..." There was no need to complete the sentence.

Rani studied him in silence for a few moments, then decided that argument was futile.

"I'll tell Dravindra," she said. "And Jaya - in case they have to carry you back."

"Very well-though I'm sure Dravindra could manage that by himself."

Rani gave him a delighted smile, mingling pride and pleasure. This couple, he thought fondly, had been his luckiest draw in the state lottery, and he hoped that their two years of social service had been as enjoyable to them as it had been to him. In this age, personal servants were the rarest of luxuries, awarded only to men of outstanding merit, Rajasinghe knew of no other private citizen who had three.

To conserve his strength, he rode a sun-powered trike through the Pleasure Gardens; Dravindra and Jaya preferred to walk, claiming that it was quicker. (They were right; but they were able to take shortcuts.) He climbed very slowly, pausing several times for breath, until he had reached the long corridor of the Lower Gallery, where the Mirror Wall ran parallel to the face of the Rock.

Watched by the usual inquisitive tourists, a young archaeologist from one of the African countries was searching the wall for inscriptions, with the aid of a powerful oblique light. Rajasinghe felt like warning her that the chance of making a new discovery was virtually zero. Paul Sarath had spent twenty years going over every square millimetre of the surface, and the three-volume Takkagala Graffiti was a monumental work of scholarship which would never be

superseded - if only because no other man would ever again be so skilled at reading archaic Taprobani inscriptions. They had both been young men when Paul had begun his life's work. Rajasinghe could remember standing at this very spot while the then Deputy Assistant Epigrapher of the Department of Archaeology had traced out the almost indecipherable marks on the yellow plaster, and translated the poems addressed to the beauties on the rock above. After all these centuries, the lines could still strike echoes in the human heart:

I am Tissa, Captain of the Guard.

I came fifty leagues to see the doe-eyed ones,

but they would not speak to me.

Is this kind?

May you remain here for a thousand years, like the hare which the King of the Gods

painted on the Moon. I am the priest Mahinda

from the vihara of Tuparama.

That hope had been partly fulfilled, partly denied. The ladies of the rock had been standing here for twice the time that the cleric had imagined, and had survived into an age beyond his uttermost dreams. But how few of them were left! Some of the inscriptions referred to "five hundred golden-skinned maidens"; even allowing for considerable poetic licence, it was clear that not one-tenth of the original frescoes had escaped the ravages of time or the malevolence of man. But the twenty that remained were now safe forever, their beauty stored in countless films and tapes and crystals.

Certainly they had outlasted one proud scribe, who had thought it quite unnecessary to give his name:

I ordered the road to be cleared, so that

pilgrims could see the fair maidens standing

on the mountainside.

I am the King.

Over the years Rajasinghe - himself the bearer of a royal name, and doubtless host to many regal genes - had often thought of those words; they demonstrated so perfectly the ephemeral nature of power, and the futility of ambition. "I am the King." Ah, but which King? The monarch who had stood on

these granite flag-stones - scarcely worn then, eighteen hundred years ago - was probably an able and intelligent man; but he failed to conceive that the time could ever come when he would fade into an anonymity as deep as that of his humblest subjects.

The attribution was now lost beyond trace. At least a dozen kings might have inscribed those haughty lines; some had reigned for years, some only for weeks, and few indeed had died peacefully in their beds. No-one would ever know if the king who felt it needless to give his name was Mahatissa II, or Bhatikabhaya, or Vijayakumara III, or Gajabahukagamani, or Candamukhasiva, or Moggallana I, or Kittisena, or Sirisamghabodhi... or some other monarch not even recorded in the long and tangled history of Taprobane.

The attendant operating the little elevator was astonished to see his distinguished visitor, and greeted Rajasinghe deferentially. As the cage slowly ascended the full fifteen metres, he remembered how he would once have spurned it for the spiral stairway, up which Dravindra and Jaya were bounding even now in the thoughtless exuberance of youth.

The elevator clicked to a halt, and he stepped on to the small steel platform built out from the face of the cliff. Below and behind were a hundred metres of empty space, but the strong wire mesh gave ample security; not even the most determined suicide could escape from the cage - large enough to hold a dozen people - clinging to the underside of the eternally breaking wave of stone.

Here in this accidental indentation, where the rock-face formed a shallow cave and so protected them from the elements, were the survivors of the king's heavenly court. Rajasinghe greeted them silently, then sank gratefully into the chair that was offered by the official guide.

"I would like," he said quietly, "to be left alone for ten minutes. Jaya - Dravindra - see if you can head off the tourists."

His companions looked at him doubtfully; so did the guide, who was supposed never to leave the frescoes unguarded. But, as usual, Ambassador Rajasinghe had his way, without even raising his voice.

"Ayu bowan," he greeted the silent figures, when he was alone at last. "I'm sorry to have neglected you for so long."

He waited politely for an answer, but they paid no more attention to him than to all their other admirers for the last twenty centuries. Rajasinghe was not discouraged; he was used to their indifference. Indeed, it added to their charm.

"I have a problem, my dears," he continued. "You have watched all the invaders of Taprobane come and go, since Kalidasa's time. You have seen the jungle flow like a tide around Yakkagala, and then retreat before the axe and the plough. But nothing has really changed in all those years. Nature has been kind to little Taprobane, and so has History; it has left her alone."

"Now the centuries of quiet may be drawing to a close. Our land may become the centre of the world of many worlds. The great mountain you have watched so long, there in the south, may be the key to the universe. If that is so, the Taprobane we knew and loved will cease to exist.

"Perhaps there is not much that I can do but I have some power to help, or to hinder. I still have many friends; if I wish, I can delay this dream - or nightmare - at least beyond my lifetime. Should I do so? Or should I give aid to this man, whatever his real motives may be?"

He turned to his favourite - the only one who did not avert her eyes when he gazed upon her. All the other maidens stared into the distance, or examined the flowers in their hands; but the one he had loved since his youth seemed, from a certain angle, to catch his glance.

"Ah, Karuna! It's not fair to ask you such questions. For what could you possibly know of the real worlds beyond the sky, or of men's need to reach them? Even though you were once a goddess, Kalidasa's Heaven was only an illusion. Well, whatever strange futures you may see, I shall not share them. We have known each other a long time - by my standards, if not by yours. While I can, I shall watch you from the villa; but I do not think that we shall meet again. Farewell - and thank you, beautiful ones, for all the pleasure you have brought me down the years. Give my greetings to those who come after me."

Yet as he descended the spiral stairs - ignoring the elevator - Rajasinghe did not feel at all in a valedictory mood. On the contrary, it seemed to him that he had shed quite a few of his years (and, after all, seventy-two was not really old). He could tell that Dravindra and Jaya had noticed the spring in his step, by the way their faces lit up.

Perhaps his retirement had been getting a little dull. Perhaps both he and Taprobane needed a breath of fresh air to blow away the cobwebs - just as the monsoon brought renewed life after the months of torpid, heavy skies.

Whether Morgan succeeded or not, his was an enterprise to fire the imagination and stir the soul. Kalidasa would have envied - and approved.

II - THE TEMPLE

While the different religions wrangle with one another as to which of them is in possession of the truth, in our view the truth of religion may be altogether disregarded... If one attempts to assign to religion its place in man's evolution, it seems not so much to be a lasting acquisition, as a parallel to the neurosis which the civilised individual must pass through on his way from childhood to maturity.

Freud: New Introductory Lectures on Psycho-Analysis (1932).

Of course man made God in his own image; but what was the alternative? Just as a real understanding of geology was impossible until we were able to study other worlds beside Earth, so a valid theology must await contact with extra-terrestrial intelligences. There can be no such subject as comparative religion, as long as we study only the religions of man.

El Hadj Mohammed ben Selim, Professor of Comparative Religion: Inaugural Address, Brigham Young University, 1998.

We must await, not without anxiety, the answers to the following questions; (a) What, if any, are the religious concepts of entities with zero, one, two, or more than two 'parents' (b) is religious belief found only among organisms that have close contact with their direct progenitors during their formative years?

If we find that religion occurs exclusively among intelligent analogs of apes, dolphins, elephants, dogs, etc., but not among extra-terrestrial computers, termites, fish, turtles or social amoebae, we may have to draw some painful conclusions .. Perhaps both love and religion can arise only among mammals, and for much the same reasons. This is also suggested by a study of their pathologies; anyone who doubts the connection between religious fanaticism and perversion should take a long, hard look at the Malleus Maleficarium or Huxley's The Devils of Loudon.

(Ibid.)

Dr. Charles Willis' notorious remark (Hawaii, 5970) that "Religion is a by-product of malnutrition" is not, in itself, much more helpful than Gregory Bateson's somewhat indelicate one-syllable refutation. What Dr. Willis apparently meant was (i) the hallucinations caused by voluntary or involuntary starvation are readily interpreted as religious visions (2) hunger in this life encourages belief in a compensatory afterlife, as a - perhaps essential - psychological survival mechanism...

It is indeed one of the ironies of fate that research into the so-called consciousness-expanding drugs proved that they did exactly the opposite, by leading to the detection of the naturally occurring "apothetic" chemicals in the brain. The discovery that the most devout adherent of any faith could be converted to any other by a judicious dose of 2-4-7 ortho-para-theosamine was, perhaps, the most devastating blow ever received by religion.

Until, of course, the advent of Starglider.

R. Gabor: The Pharmacological Basis of Religion (Miskatonic University Press, 2069).

12. Starglider

Something of the sort had been expected for a hundred years, and there had been many false alarms. Yet when it finally happened, mankind was taken by surprise.

The radio signal from the direction of Alpha Centauri was so powerful that it was first detected as interference on normal commercial circuits. This was highly embarrassing to all the radio astronomers who, for so many decades, had been seeking intelligent messages from space - especially as they had long ago dismissed the triple system of Alpha, Beta and Proxima Centauri from all serious consideration.

At once, every radio telescope that could scan the southern hemisphere was focused upon Centaurus. Within hours, a still more sensational discovery was made. The signal was not coming from the Centaurus system at all - but from a point half a degree away. And it was moving.

That was the first hint of the truth. When it was confirmed, all the normal business of mankind came to a halt.

The power of the signal was no longer surprising; its source was already well inside the solar system, and moving sunward at six hundred kilometres a second. The long-awaited, long-feared visitors from space had arrived at last.

Yet for thirty days the intruder did nothing, as it fell past the outer planets, broadcasting an unvarying series of pulses that merely announced "Here I am!". It made no attempt to answer the signals beamed at it, nor did it make any adjustments to its natural, comet-like orbit. Unless it had slowed down from some much higher speed, its voyage from Centaurus must have lasted two thousand years. Some found this reassuring, since it suggested that the visitor was a robot space-probe; others were disappointed, feeling that the absence of real, live extra-terrestrials would be an anti-climax.

The whole spectrum of possibilities was argued, ad nauseam, in all the media of communications, all the parliaments of man.

Every plot that had ever been used in science fiction, from the arrival of benevolent gods to an invasion of blood-sucking vampires, was disinterred and solemnly analysed. Lloyds of London collected substantial premiums from people insuring against every possible future - including some in which there would have been very little chance of collecting a penny.

Then, as the alien passed the orbit of Jupiter, man's instruments began to learn something about it. The first discovery created a short-lived panic; the object was five hundred kilometres in diameter - the size of a small moon. Perhaps, after all, it was a mobile world, carrying an invading army.

This fear vanished when more precise observations showed that the solid body of the intruder was only a few metres across. The five-hundred-kilometre halo around it was something very familiar - a flimsy, slowly revolving parabolic reflector, the exact equivalent of the astronomers' orbiting radio telescopes. Presumably this was the antenna through which the visitor kept in touch with its distant base. And through which, even now, it was doubtless beaming back its discoveries, as it scanned the solar system and eavesdropped upon all the radio, TV and data broadcasts of mankind.

Then came yet another surprise. That asteroid-sized antenna was not pointed in the direction of Alpha Centauri, but towards a totally different part of the sky. It began to look as if the Centauri system was merely the vehicle's last port of call, not its origin.

The astronomers were still brooding over this when they had a remarkable stroke of luck. A solar weather probe on routine patrol beyond Mars became suddenly dumb, then recovered its radio voice a minute later. When the records were examined, it was found that the instruments had been momentarily paralysed by intense radiation. The probe had cut right across the visitor's beam - and it was then a simple matter to calculate precisely where it was aimed.

There was nothing in that direction for fifty-two light-years, except a very faint - and presumably very old - red dwarf star, one of those abstemious little suns that would still be shining peacefully billions of years after the galaxy's splendid giants had burned themselves out. No radio telescope had ever examined it closely; now all those that could be spared from the approaching visitor were focused upon its suspected origin.

And there it was, beaming a sharply-tuned signal in the one centimetre band. The makers were still in contact with the vehicle they had launched, thousands of years ago; but the messages it must be receiving now were from only half a century in the past.

Then, as it came within the orbit of Mars, the visitor showed its first awareness of mankind, in the most dramatic and unmistakable way that could be imagined. It started transmitting standard 3075-line television pictures, interleaved with video text in fluent though stilted English and Mandarin. The first cosmic conversation had begun - and not, as had always been imagined, with a delay of decades, but only of minutes.

13. Shadow at Dawn

Morgan had left his hotel in Ranapura at four a.m. on a clear, moonless night. He was not too happy about the choice of time, but Professor Sarath, who had made all the arrangements, had promised him that it would be well worthwhile. "You won't understand anything about Sri Kanda," he had said, "unless you have watched the dawn from the summit. And Buddy - er, the Maha Thero - won't receive visitors at any other time. He says it's a splendid way of discouraging the merely curious." So Morgan had acquiesced with as much good grace as possible.

To make matters worse, the Taprobanean driver had persisted in carrying on a brisk though rather one-sided conversation, apparently designed to establish a complete profile of his passenger's personality. This was all done with such ingenuous good nature that it was impossible to take offence, but Morgan would have preferred silence.

He also wished, sometimes devoutly, that his driver would pay rather more attention to the countless hairpin bends round which they zipped in the near-darkness. Perhaps it was just as well that he could not see all the cliffs and chasms they were negotiating as the car climbed up through the foothill. This road was a triumph of nineteenth-century military engineering - the work of the last colonial power, built in the final campaign against the proud mountain folk of the interior. But it had never been converted to automatic operation, and there were times when Morgan wondered if he would survive the journey.

And then, suddenly, he forgot his fears and his annoyance at the loss of sleep.

"There it is!" said the driver proudly, as the car rounded the flank of a hill.

Sri Kanda itself was still completely invisible in a darkness which as yet bore no hint of the approaching dawn. Its presence was revealed by a thin ribbon of light, zig-zagging back and forth under the stars, hanging as if by magic in the sky. Morgan knew that he was merely seeing the lamps set two hundred years ago to guide pilgrims as they ascended the longest stairway in the world, but in its defiance of logic and gravity it appeared almost a prevision of his own dream. Ages before he was born, inspired by philosophers he could barely imagine, men had begun the work he hoped to finish. They had, quite literally, built the first crude steps on the road to the stars.

No longer feeling drowsy, Morgan watched as the band of light grew closer, and resolved itself into a necklace of innumerable, twinkling beads. Now the mountain was becoming visible, as a black triangle eclipsing half the sky. There was something sinister about its silent, brooding presence; Morgan could almost imagine that it was indeed the abode of gods who knew of his mission, and were gathering their strength against him.

These ominous thoughts were entirely forgotten when they arrived at the cable car terminus and Morgan discovered to his surprise - it was still only five a.m. - that at least a hundred people were milling around in the little waiting-room. He ordered a welcome hot coffee for himself and his garrulous driver - who, rather to his relief, showed no interest in making the ascent. "I've done it at least twenty times," he said with perhaps exaggerated boredom. "I'm going to sleep in the car until you come down."

Morgan purchased his ticket, did a quick calculation, and estimated that he would be in the third or fourth load of passengers. He was glad that he had taken Sarath's advice and slipped a thermocloak in his pocket; at a mere two-kilometre altitude, it was already quite cold. At the summit, three kilometres higher still, it must be freezing.

As he slowly shuffled forward in the rather subdued and sleepy line of visitors, Morgan noted with amusement that he was the only one not carrying a camera. Where were the genuine pilgrims, he wondered? Then he remembered; they would not be here. There was no easy way to heaven, or Nirvana, or whatever it was that the faithful sought. Merit was acquired solely by one's own efforts, not with the aid of machines. An interesting doctrine, and one containing much truth; but there were also times when only machines could do the job.

At last he got a seat in the car, and with a considerable creaking of cables they were on their way. Once again, Morgan felt that eerie sense of anticipation. The elevator he was planning would hoist loads more than ten thousand times as high as this primitive system, which probably dated right back to the twentieth century. And yet, when all was said and done, its basic principles were very much the same. Outside the swaying car was total darkness, except when a section of the illuminated stairway came into view. It was completely deserted, as if the countless millions who had toiled up the mountain during the last three thousand years had left no successor. But then Morgan realised that those making the ascent on foot would already be far above on their appointment with the dawn; they would have left the lower slopes of the mountain hours ago.

At the four-kilometre level the passengers had to change cars and walk a short distance to another cable-station, but the transfer involved little delay. Now Morgan was indeed glad of his cloak, and wrapped its metallised fabric closely round his body. There was frost underfoot, and already he was breathing deeply in the thin air. He was not at all surprised to see racks of oxygen cylinders in the small terminus, with instructions for their use prominently displayed.

And now at last, as they began the final ascent, there came the first intimation of the approaching day. The eastern stars still shone with undiminished glory - Venus most brilliantly of all - but a few thin, high clouds began to glow faintly with the coming dawn. Morgan looked anxiously at his watch, and wondered if he would be in time. He was relieved to see that daybreak was still thirty minutes away.

One of the passengers suddenly pointed to the immense stairway, sections of which were occasionally visible beneath them as it zigzagged back and forth up the mountain's now rapidly steepening slopes. It was no longer deserted; moving with dreamlike slowness, dozens of men and women were toiling painfully up the endless steps. Every minute more and more came into view; for how many hours, Morgan wondered, had they been climbing? Certainly all through the night, and perhaps much longer-for many of the pilgrims were quite elderly, and could hardly have managed the ascent in a single day. He was surprised to see that so many still believed.

A moment later, he saw the first monk - a tall, saffron-robed figure moving with a gait of metronome-like regularity, looking neither to the right nor to the left, and completely ignoring the car floating above his shaven head. He also appeared capable of ignoring the elements, for his right arm and shoulder were bare to the freezing wind.

The cable car was slowing down as it approached the terminus; presently it made a brief halt, disgorged its numbed passengers, and set off again on its long descent. Morgan joined the crowd of two or three hundred people huddling in a small amphitheatre cut in the western face of the mountain. They were all staring out into the darkness, though there was nothing to see but the ribbon of light winding down into the abyss. Some belated climbers on the last section of the stairway were making a final effort, as faith strove to overcome fatigue.

Morgan looked again at his watch; ten minutes to go. He had never before been among so many silent people; camera-touting tourists and devout pilgrims were united now in the same hope. The weather was perfect; soon they would all know if they had made this journey in vain.

There came a delicate tinkling of bells from the temple, still invisible in the darkness a hundred metres above their heads; and at the same instant all the lights along that unbelievable stairway were extinguished. Now they could see, as they stood with their backs towards the hidden sunrise, that the first faint gleam of day lay on the clouds far below; but the immense bulk of the mountain still delayed the approaching dawn.

Second by second the light was growing on either side of Sri Kanda, as the sun outflanked the last strongholds of the night. Then there came a low murmur of awe from the patiently waiting crowd.

One moment there was nothing. Then, suddenly, it was there, stretching half the width of Taprobane - a perfectly symmetrical, sharp-edged triangle of deepest blue. The mountain had not forgotten its worshippers; there lay its famous shadow across the sea of clouds, a symbol for each pilgrim to interpret as he wished.

It seemed almost solid in its rectilinear perfection, like some overturned pyramid rather than a mere phantom of light and shade. As the brightness grew around it, and the first direct rays of the sun struck past the flanks of the mountain, it appeared by contrast to grow even darker and denser; yet through the thin veil of cloud responsible for its brief existence, Morgan could dimly discern the lakes and hills and forests of the awakening land.

The apex of that misty triangle must be racing towards him at enormous speed, as the sun rose vertically behind the mountain, yet Morgan was conscious of no movement. Time seemed to have been suspended; this was one of the rare moments of his life when he gave no thought to the passing minutes. The shadow of eternity lay upon his soul, as did that of the mountain upon the clouds.

Now it was fading swiftly, the darkness draining from the sky like a stain dispersing in water. The ghostly, glimmering landscape below was hardening into reality; halfway to the horizon there was an explosion of light as the sun's rays struck upon some building's eastern windows. And even beyond that - unless his eyes had tricked him - Morgan could make out the faint, dark band of the encircling sea.

Another day had come to Taprobane.

Slowty, the visitors dispersed. Some returned to the cable-car terminus, while others, more energetic, headed for the stairway, in the mistaken belief that the descent was easier than the climb. Most of them would be thankful enough to catch the car again at the lower station; few indeed would make it all the way down.

Only Morgan continued upwards, followed by many curious glances, along the short flight of steps that led to the monastery and to the very summit of the mountain. By the time he had reached the smoothly-plastered outer wall - now beginning to glow softly in the first direct rays of the sun - he was very short of breath, and was glad to lean for a moment against the massive wooden door.

Someone must have been watching; before he could find a bell-push, or signal his presence in any way, the door swung silently open, and he was welcomed by a yellow-robed monk, who saluted him with clasped hands.

"Ayu bowan, Dr. Morgan. The Mahanayake Thero will be glad to see you."

14. The Education of Starglider

(Extract from Starglider Concordance, First Edition, 2071)

We now know that the interstellar spaceprobe generally referred to as Starglider is completely autonomous, operating according to general instructions programmed into it sixty thousand years ago. While it is cruising between suns, it uses its five-hundred-kilometre antenna to send back information to its base at a relatively slow rate, and to receive occasional up-dates from "Starholme", to adopt the lovely name coined by the poet Liwellyn ap Cymru.

While it is passing through a solar system, however, it is able to tap the energy of a sun, and so its rate of information transfer increases enormously. It also "recharges its batteries", to use a doubtless crude analogy. And since - like our own early Pioneers and Voyagers - it employs the gravitational fields of the heavenly bodies to deflect it from star to star, it will operate indefinitely, unless mechanical failure or cosmic accident terminates its career. Centaurus was its eleventh port of call; after it had rounded our sun like a comet, its new course was aimed precisely at Tau Ceti, twelve light years away. If there is anyone there, it will be ready to start its next conversation soon after AD 8100.

For Starglider combines the functions both of ambassador and explorer. When, at the end of one of its millennial journeys, it discovers a technological culture, it makes friends with the natives and starts to trade information, in the only form of interstellar commerce that may ever be possible. And before it departs again on its endless voyage, after its brief transit of their solar system, Starglider gives the location of its home world - already awaiting a direct call from the newest member of the galactic telephone exchange.

In our case, we can take some pride in the fact that, even before it had transmitted any star charts, we had identified its parent sun and even beamed our first transmissions to it. Now we have only to wait 104 years for an answer. How incredibly lucky we are, to have neighbours so close at hand.

It was obvious from its very first messages that Starglider understood the meaning of several thousand basic English and Chinese words, which it had deduced from an analysis of television, radio and - especially - broadcast video-text services. But what it had picked up during its approach was a very unrepresentative sample from the whole spectrum of human culture; it contained little advanced science, still less advanced mathematics - and only a random selection of literature, music and the visual arts.

Like any self-taught genius, therefore, Starglider had huge gaps in its education. On the principle that it was better to give too much than too little, as soon as contact was established Starglider was presented with the Oxford English Dictionary, the Great Chinese Dictionary (Romandarin edition), and the Encyclopaedia Terrae. Their digital transmission required little more than fifty minutes, and it was notable that, immediately thereafter, Starglider was silent for almost four hours - its longest period off the air. When it resumed contact, its vocabulary was immensely enlarged, and for over 99 percent of the time it could pass the Turing test with ease - i.e., there was no way of telling from the messages received that Starglider was a machine, and not a highly intelligent human.

There were occasional giveaways - for example, incorrect use of ambiguous words, and the absence of emotional content in the dialogue. This was only to be expected; unlike advanced terrestrial computers - which could replicate the emotions of their builders, when necessary - Starglider's feelings and desires were presumably those of a totally alien species, and therefore largely incomprehensible to man.

And, of course, vice versa. Starglider could understand precisely and completely what was meant by "the square on the hypotenuse equals the sum of the squares on the other two sides". But it could scarcely have the faintest glimmer of what lay in Keats' mind when he wrote:

Charmed magic casements, opening on the foam Of perilous seas, in faery lands forlorn...

Still less - Shall I compare thee to a summer's day?

Thou art more lovely and more temperate.

Nevertheless, in the hope of correcting this deficiency, Starglider was also presented with thousands of hours of music, drama, and scenes from terrestrial life, both human and otherwise. By general agreement, a certain amount of censorship was enforced here. Although mankind's propensity for violence and warfare could hardly be denied (it was too late to recall the Encyclopaedia) only a few carefully selected examples were broadcast. And, until Starglider was safely out of range, the normal fare of the video networks was uncharacteristically bland.

For centuries - perhaps, indeed, until it had reached its next target - philosophers would be debating Starglider's real understanding of human affairs and problems. But on one point there was no serious disagreement. The hundred days of its passage through the solar system altered irrevocably men's views of the universe, its origin, and their place in it.

Human civilisation could never be the same, after Starglider had gone.

15. Bodhidharma

As the massive door, carved with intricate lotus patterns, clicked softly shut behind him, Morgan felt that he had entered another world. This was by no means the first time he had been on ground once sacred to some great religion; he had seen Notre Dame, Saint Sophia, Stonehenge, the Parthenon, Karnak, Saint Paul's, and at least a dozen other major temples and mosques. But he had viewed them all as frozen relics of the past - splendid examples of art or engineering, but with no relevance to the modern mind. The faiths that had created and sustained them had all passed into oblivion, though some had survived until well into the twenty-second century.

But here, it seemed, time had stood still. The hurricanes of history had blown past this lonely citadel of faith, leaving it unshaken. As they had done

for three thousand years, the monks still prayed, and meditated, and watched the dawn.

During his walk across the worn flagstones of the courtyard, polished smooth by the feet of innumerable pilgrims, Morgan experienced a sudden and wholly uncharacteristic indecision. In the name of progress, he was attempting to destroy something ancient and noble; and something that he would never fully understand.

The sight of the great bronze bell, hanging in a campanile that grew out of the monastery wall, stopped Morgan in his tracks. Instantly, his engineer's mind had estimated its weight at not less than five tons, and it was obviously very old. How on earth... ?

The monk noticed his curiosity, and gave a smile of understanding.

"Two thousand years old," he said. "It was a gift from Kalidasa the Accursed, which we felt it expedient not to refuse. According to legend, it took ten years to carry it up the mountain - and the lives of a hundred men."

"When is it used?" asked Morgan, after he had digested this information.

"Because of its hateful origin, it is sounded only in time of disaster. I have never heard it, nor has any living man. It tolled once, without human aid, during the great earthquake of 2057. And the time before that was 1522, when the Iberian invaders burned the Temple of the Tooth and seized the Sacred Relic."

"So after all that effort - it's never been used?"

"Perhaps a dozen times in the last two thousand years. Kalidasa's doom still lies upon it."

That might be good religion, Morgan could not help thinking, but hardly sound economics. And he wondered irreverently how many monks had succumbed to the temptation of tapping the bell, ever so gently, just to hear for themselves the unknown timbre of its forbidden voice.

They were walking now past a huge boulder, up which a short flight of steps led to a gilded pavilion. This, Morgan realised, was the very summit of the mountain; he knew what the shrine was supposed to hold, but once again the monk enlightened him.

"The footprint," he said. "The Muslims believed it was Adam's; he stood here after he was expelled from Paradise. The Hindus attributed it to Siva or Saman. But to the Buddhists, of course, it was the imprint of the Enlightened One."

"I notice your use of the past tense," Morgan answered in a carefully neutral voice. "What is the belief now?"

The monk's face showed no emotion as he replied: "The Buddha was a man, like you and me. The impression in the rock - and it is very hard rock - is two metres long."

That seemed to settle the matter, and Morgan had no further questions while he was led along a short cloister that ended at an open door. The monk knocked, but did not wait for any response as he waved the visitor to enter.

Morgan had half-expected to find the Mahanayake Thero sitting cross-legged on a mat, probably surrounded by incense and chanting acolytes. There was, indeed, just a hint of incense in the chill air, but the Chief Incumbent of the Sri Kanda vihare sat behind a perfectly ordinary office desk, equipped with standard display and memory units. The only unusual item in the room was the head of the Buddha, slightly larger than life, on a plinth in one corner. Morgan could not tell whether it was real, or merely a projection.

Despite his conventional setting, there was little likelihood that the head of the monastery would be mistaken for any other type of executive. Quite apart from the inevitable yellow robe, the Mahanayake Thero had two other characteristics that, in this age, were very rare indeed. He was completely bald; and he was wearing spectacles.

Both, Morgan assumed, were by deliberate choice. Since baldness could be so easily cured, that shining ivory dome must have been shaved or depilated. And he could not remember when he had last seen spectacles, except in historical recordings or dramas.

The combination was fascinating, and disconcerting. Morgan found it virtually impossible to guess the Mahanayake Thero's age; it could be anything from a mature forty to a well-preserved eighty. And those lenses, transparent though they were, somehow concealed the thoughts and emotions behind them.

"Ayu bowan, Dr. Morgan," said the prelate, gesturing his visitor to the only empty chair. "This is my secretary, the Venerable Parakarma. I trust you won't mind if he makes notes."

"Of course not," said Morgan, inclining his head towards the remaining occupant of the small room. He noticed that the younger monk had flowing hair and an impressive beard; presumably shaven pates were optional.

"So, Dr. Morgan," the Mahanayake Thero continued, "you want our mountain."

"I'm afraid so, your - er - reverence. Part of it, at any rate."

"Out of all the world - these few hectares?"

"The choice is not ours, but Nature's. The earth terminus has to be on the equator, and at the greatest possible altitude, where the low air density maintains wind forces."

"There are higher equatorial mountains in Africa and South America."

Here we go again, Morgan groaned silently. Bitter experience had shown him that it was almost impossible to make laymen, however intelligent and interested, appreciate this problem, and he anticipated even less success with these monks. If only the earth was a nice, symmetrical body, with no dents and bumps in its gravitational field.

"Believe me," he said fervently, "we've looked at all the alternatives. Cotopaxi and Mount Kenya - and even Kilimanjaro, though that's three degrees south-would be fine except for one fatal flaw. When a satellite is established in the stationary orbit, it won't stay exactly over the same spot. Because of gravitational irregularities, which I won't go into, it will slowly drift along the equator. So all our synchronous satellites and space-stations have to burn propellent to keep them on station; luckily the amount involved is quite small.

But you can't keep nudging millions of tons - especially when it's in the form of slender rod tens of thousands of kilometres long - back into position. And there's no need to. Fortunately for us -"

"- not for us," interjected the Mahanayake Thero, almost throwing Morgan off his stride.

"- there are two stable points on the synchronous orbit. A satellite placed at them will stay there - it won't drift away. Just as if it's stuck at the bottom of an invisible valley. One of those points is out over the Pacific, so it's no use to us. The other is directly above our heads."

"Surely a few kilometres one way or the other would make no difference. There are other mountains in Taprobane."

"None more than half the height of Sri Kanda - which brings us down to the level of critical wind forces. True, there are not many hurricanes exactly on the equator. But there are enough to endanger the structure, at its very weakest point."

"We can control the winds."

It was the first contribution the young secretary had made to the discussion, and Morgan looked at him with heightened interest.

"To some extent, yes. Naturally, I have discussed this point with Monsoon Control. They say that absolute certainty is out of the question especially with hurricanes. The best odds they will give me are fifty to one. That's not good enough for a trillion dollar project."

The Venerable Parakarma seemed inclined to argue. "There is an almost forgotten branch of mathematics, called Catastrophe Theory, which could make meteorology a really precise science. I am confident that -"

"I should explain," the Mahanayake Thero interjected blandly, "that my colleague was once rather celebrated for his astronomical work. I imagine you have heard of Dr. Choam Goldberg."

Morgan felt that a trap-door had been suddenly opened beneath him. He should have been warned! Then he recalled that Professor Sarath had indeed told him, with a twinkle in his eye, that he should "watch out for Buddy's private secretary - he's a very smart character".

Morgan wondered if his cheeks were burning, as the Venerable Parakarma, alias Dr. Choam Goldberg, looked back at him with a distinctly unfriendly expression. So he had been trying to explain orbital instabilities to these innocent monks; the Mahanayake Thero had probably received much better briefing on the subject than he had done.

And he remembered that the world's scientists were neatly divided on the subject of Dr. Goldberg... those who were sure that he was crazy, and those who had not yet made up their minds. For he had been one of the most promising young men in the field of astrophysics when, five years ago, he had announced, "Now that Starglider has effectively destroyed all traditional religions, we can at last pay serious attention to the concept of God."

And, with that, he had disappeared from public view.

16. Conversations with Starglider

Of all the thousands of questions put to Starglider during its transit of the solar system, those whose answers were most eagerly awaited concerned the living creatures and civilisations of other stars. Contrary to some expectations, the robot answered willingly, though it admitted that its last update on the subject had been received over a century ago.

Considering the immense range of cultures produced on Earth by a single species, it was obvious that there would be even greater variety among the stars, where every conceivable type of biology might occur. Several thousand hours of fascinating - often incomprehensible, sometimes horrifying - scenes of life on other planets left no doubt that this was the case.

Nevertheless, the Starholmers had managed a rough classification of cultures according to their standards of technology - perhaps the only objective basis possible. Humanity was interested to discover that it came number five on a scale which was defined approximately by: 1 - Stone tools. 2 - Metals, fire. 3 - Writing, handicrafts, ships. 4 - Steam power, basic science. 5 - Atomic energy, space travel.

When Starglider had begun its mission, sixty thousand years ago, its builders were, like the human race, still in category Five. They had now graduated to Six, characterised by the ability to convert matter completely into energy, and to transmute all elements on an industrial scale.

"And is there a Class Seven?" Starglider was immediately asked. The reply was a brief "Affirmative". When pressed for details, the probe explained: "I am not allowed to describe the technology of a higher grade culture to a lower one." There the matter remained, right up to the moment of the final message, despite all the leading questions designed by the most ingenious legal brains of Earth.

For by this time Starglider was more than a match for any terrestrial logician. This was partly the fault of the University of Chicago's Department of Philosophy; in a fit of monumental hubris, it had clandestinely transmitted the whole of the Summa Theologica, with disastrous results.

2069 June 02 GMT 19.34. Message 1946, sequence 2.

Starglider to Earth:

I have analysed the arguments of your Saint Thomas Aquinas as requested in your message 145 sequence 3 of 2069 June 02 GMT 18.42. Most of the content appears to be sense-free random noise and so devoid of information, but the

printout that follows lists 192 fallacies expressed in the symbolic logic of your reference Mathematics 43 of 2069 May 29 GMT 02.51.

Fallacy I... (hereafter a 75-page printout.)

As the log timings show, it took Starglider rather less than an hour to demolish Saint Thomas. Although philosophers were to spend the next several decades arguing over the analysis, they found only two errors; and even those could have been due to a misunderstanding of terminology.

It would have been most interesting to know what fraction of its processing circuits Starglider applied to this task; unfortunately, no-one thought of asking before the probe had switched to cruise mode and broken contact. By then, even more deflating messages had been received...

2069 June 04 GMT 07.59 Message 9056 sequence 2.

Starglider to Earth:

I am unable to distinguish clearly between your religious ceremonies and apparently identical behaviour at the sporting and cultural functions you have transmitted to me. I refer you particularly to the Beatles, 1965; the World Soccer Final, 2046; and the Farewell appearance of the Johann Sebastian Clones, 2056.

2069 June 05 GMT 20.38 Message 4675 sequence 2. Starglider to Earth:

My last update on this matter is 175 years old, but if I understand you correctly the answer is as follows. Behaviour of the type you call religious occurred among 3 of the 15 known Class One cultures, 6 of the 28 Class Two cultures, 5 of the 14 Class Three cultures, 2 of the 10 Class Four cultures, and 3 of the 174 Class Five cultures. You will appreciate that we have many more examples of Class Five, because only they can be detected over astronomical distances.

2069 June 06 GMT 12.09 Message 5897 sequence 2. Starglider to Earth:

You are correct in deducing that the 3 Class Five cultures that engaged in religious activities all had two-parent reproduction and the young remained in family groups for a large fraction of their lifetime. How did you arrive at this conclusion?

2069 June 08 GMT 15.37 Message 6943 sequence 2. Starglider to Earth:

The hypothesis you refer to as God, though not disprovable by logic alone, is unnecessary for the following reason.

If you assume that the universe can be quote explained unquote as the creation of an entity known as God, he must obviously be of a higher degree of organisation than his product. Thus you have more than doubled the size of the original problem, and have taken the first step on a diverging infinite regress. William of Ockham pointed out as recently as your fourteenth century that entities should not be multiplied unnecessarily. I cannot therefore understand why this debate continues.

2069 June 11 GMT 06.84. Message 8964 sequence 2. Starglider to Earth:

Starholme informed me 456 years ago that the origin of the universe has been discovered but that I do not have the appropriate circuits to comprehend it. You must communicate direct for further information.

I am now switching to cruise mode and must break contact. Goodbye.

In the opinion of many, that final and most famous of all its thousands of messages proved that Starglider had a sense of humour. For why else would it have waited until the very end to explode such a philosophical bomb-shell? Or was the entire conversation all part of a careful plan, designed to put the human race in the right frame of reference - when the first direct messages from Starholme arrived in, presumably, 104 years?

There were some who suggested following Starglider, since it was carrying out of the solar system not only immeasurable stores of knowledge, but the treasures of a technology centuries ahead of anything possessed by man. Although no spaceship now existed that could overtake Starglider - and return again to earth after matching its enormous velocity one could certainly be built.

However, wiser councils prevailed. Even a robot space-probe might have very effective defences against boarders - including, as a last resort, the ability to self-destruct. But the most telling argument was that its builders were "only" fifty-two light years away. During the millennia since they had launched Starglider, their spacefaring ability must have improved enormously. If the human race did anything to provoke them they might arrive, slightly annoyed, in a very few hundred years.

Meanwhile, among all its countless other effects upon human culture, Starglider had brought to its climax a process that was already well under way. It had put an end to the billions of words of pious gibberish with which apparently intelligent men had addled their minds for centuries.

17. Parakarma

As he quickly checked back on his conversation, Morgan decided that he had not made a fool of himself. Indeed, the Mahanayake Thero might have lost a tactical advantage by revealing the identity of the Venerable Parakarma. Yet it was no particular secret; perhaps he thought that Morgan already knew.

At this point there was a rather welcome interruption, as two young acolytes filed into the office, one carrying a tray loaded with small dishes of rice, fruits and what appeared to be thin pancakes, while the other followed with the inevitable pot of tea. There was nothing that looked like meat; after his long night, Morgan would have welcomed a couple of eggs, but he assumed that they too were forbidden. No - that was too strong a word; Sarath had told him that the Order prohibited nothing, believing in no absolutes. But it had a nicely calibrated scale of toleration, and the taking of life - even potential life - was very low on the list.

As he started to sample the various items - most of them quite unknown to him - Morgan looked enquiringly at the Mahanayake Thero, who shook his head.

"We do not eat before noon. The mind functions more clearly in the morning hours, and so should not be distracted by material things."

As he nibbled at some quite delicious papaya, Morgan considered the philosophical gulf represented by that simple statement. To him, an empty stomach could be very distracting indeed, completely inhibiting the higher mental functions. Having always been blessed with good health, he had never tried to dissociate mind and body, and saw no reason why one should make the attempt.

While Morgan was eating his exotic breakfast the Mahanayake Thero excused himself, and for a few minutes his fingers danced, with dazzling speed, over the keyboard of his console. As the readout was in full view, politeness compelled Morgan to look elsewhere. Inevitably, his eyes fell upon the head of the Buddha. It was probably real, for the plinth cast a faint shadow on the wall behind. Yet even that was not conclusive. The plinth might be solid enough, and the head a projection carefully positioned on top of it; the trick was a common one.

Here, like the Mona Lisa, was a work of art that both mirrored the emotions of the observer and imposed its own authority upon them. But La Gioconda's eyes were open, though what they were looking at no-one would ever know. The eyes of the Buddha were completely blank empty pools in which a man might lose his soul, or discover a universe.

Upon the lips there lingered a smile even more ambiguous than the Mona Lisa's. Yet was it indeed a smile, or merely a trick of the lighting? Already it was gone, replaced by an expression of superhuman tranquillity. Morgan could not tear his eyes away from that hypnotic countenance, and only the familiar rustling whirr of a hard-copy readout from the console brought him back to reality - if this was reality.

"I thought you might like a souvenir of your visit," said the Mahanayake Thero.

As Morgan accepted the proffered sheet, he was surprised to see that it was archival quality parchment, not the usual flimsy paper, destined to be thrown away after a few hours of use. He could not read a single word; except for an unobtrusive alphanumeric reference in the bottom left-hand corner, it was all in the flowery curlicues which he could now recognise as Taprobani script.

"Thank you," he said, with as much irony as he could muster. "What is it?" He had a very good idea; legal documents had a close family resemblance, whatever their languages or eras.

"A copy of the agreement between King Ravindra and the Maha Sangha, dated Vesak AD 854 of your calendar. It defines the ownership of the temple land - in perpetuity. The rights set out in this document were even recognised by the invaders."

"By the Caledonians and the Hollanders, I believe. But not by the Iberians."

If the Mahanayake Thero was surprised by the thoroughness of Morgan's briefing, not even the twitch of an eyebrow betrayed the fact.

"They were hardly respecters of law and order, particularly where other religions were concerned. I trust that their philosophy of might equals right does not appeal to you."

Morgan gave a somewhat forced smile. "It certainly does not," he answered. But where did one draw the line? he asked himself silently. When the overwhelming interests of great organizations were at stake, conventional morality often took second place. The best legal minds on earth, human and electronic, would soon be focused upon this spot. If they could not find the right answers, a very unpleasant situation might develop one which could make him a villain, not a hero.

"Since you have raised the subject of the 854 agreement, let me remind you that it refers only to the land inside the temple boundaries - which are clearly defined by the walls."

"Correct. But they enclose the entire summit."

"You have no control over the ground outside this area."

"We have the rights of any owner of property. If the neighbours create a nuisance, we would have legal redress. This is not the first time the point has been raised."

"I know. In connexion with the cable-car system."

A faint smile played over the Maha Thero's lips. "You have done your homework," he commended. "Yes, we opposed it vigorously, for a number of reasons - though I admit that, now it is here, we have often been very thankful for it." He paused thoughtfully, then added: "There have been some problems, but we have been able to co-exist. Casual sightseers and tourists are content to stay on the lookout platform; genuine pilgrims, of course, we are always happy to welcome at the summit."

"Then perhaps some accommodation could be worked out in this case. A few hundred metres of altitude would make no difference to us. We could leave the summit untouched, and carve out another plateau, like the cable car terminus."

Morgan felt distinctly uncomfortable under the prolonged ~ scrutiny of the two monks. He had little doubt that they recognized the absurdity of the suggestion, but for the sake of the record he had to make it.

"You have a most peculiar sense of humour, Dr. Morgan," the Mahanayake Thero replied at last. "What would be left of the spirit of the mountain of the solitude we have sought for three thousand years - if this monstrous device is erected here? Do you expect us to betray the faith of all the millions who have come to this sacred spot, often at the cost of their health - even their lives?"

"I sympathise with your feelings," Morgan answered. (But was he lying? he wondered.) "We would, of course, do our best to minimise any disturbance. All the support facilities would be buried inside the mountain. Only the elevator would emerge, and from any distance it would be quite invisible. The general aspect of the mountain would be totally unchanged. Even your famous shadow, which I have just admired, would be virtually unaffected." The Mahanayake Thero turned to his colleague as if seeking confirmation. The Venerable Parakarma looked straight at Morgan and said: "What about noise?"

Damn, Morgan thought; my weakest point. The payloads would emerge from the mountain at several hundred kilometres an hour - the more velocity they could be given by the ground-based system the less the strain on the suspended tower. Of course, passengers couldn't take more than half a gee or so, but the capsules would still pop out at a substantial fraction of the speed of sound.

"There will be some aerodynamic noise," Morgan admitted. "But nothing like that near a large airport."

"Very reassuring," said the Mahanayake Thero. Morgan was certain that he was being sarcastic, yet could detect no trace of irony in his voice. He was either displaying an Olympian calm, or testing his visitor's reactions. The younger monk, on the other hand, made no attempt to conceal his anger.

"For years," he said with indignation, "we have been protesting about the disturbance caused by re-entering spacecraft. Now you want to generate shock waves in... in our back garden."

"Our operations will not be transonic, at this altitude," Morgan replied firmly. "And the tower structure will absorb most of the sound energy. In fact," he added, trying to press what he had suddenly seen as an advantage, "in the long run, we'll help to eliminate re-entry booms. The mountain will actually be a quieter place."

"I understand. Instead of occasional concussions, we shall have a steady roar."

I'm not getting anywhere with this character, thought Morgan; and I'd expected the Mahanayake Thero to be the biggest obstacle.

Sometimes, it was best to change the subject entirely. He decided to dip one cautious toe into the quaking quagmire of theology.

"Isn't there something appropriate," he said earnestly, "in what we are trying to do? Our purposes may be different, but the net results have much in common. What we hope to build is only an extension of your stairway. If I may say so, we're continuing it - all the way to Heaven."

For a moment, the Venerable Parakarma seemed taken aback at such effrontery. Before he could recover, his superior answered smoothly: "An interesting concept- but our philosophy does not believe in Heaven. Such salvation as may exist can be found only in this world, and I sometimes wonder at your anxiety to leave it. Do you know the story of the Tower of Babel?"

"Vaguely."

"I suggest you look it up in the old Christian Bible - Genesis II. That, too, was an engineering project to scale the heavens. It failed, owing to difficulties in communication."

"Though we shall have our problems, I don't think that will be one of them."

But looking at the Venerable Parakarma, Morgan was not so sure. Here was a communications gap which seemed in some ways greater than that between Homo sapiens and Starglider. They spoke the same language, but there were gulfs of incomprehension which might never be spanned.

"May I ask," continued the Mahanayake with imperturbable politeness, "how successful you were with the Department of Parks and Forests?"

"They were extremely co-operative."

"I am not surprised; they are chronically under-budgeted, and any new source of revenue would be welcome. The cable system was a financial windfall, and doubtless they hope your project will be an even bigger one."

"They will be right. And they have accepted the fact that it won't create any environmental hazards."

"Suppose it falls down?"

Morgan looked the venerable monk straight in the eye.

"It won't,", he said, with all the authority of the man whose inverted rainbow now linked two continents.

But he knew, and the implacable Parakarma must also know, that absolute certainty was impossible in such matters. Two hundred and two years ago, on 7 November 1940, that lesson had been driven home in a way that no engineer could ever forget.

Morgan had few nightmares, but that was one of them. Even at this moment the computers at Terran Construction were trying to exorcise it.

But all the computing power in the universe could provide no protection against the problems he had not foreseen - the nightmares that were still unborn.

18. The Golden Butterflies

Despite the brilliant sunlight and the magnificent views that assailed him on every side, Morgan was fast asleep before the car had descended into the lowlands. Even the innumerable hairpin bends failed to keep him awake - but he was suddenly snapped back into consciousness when the brakes were slammed on and he was pitched forward against his seat-belt.

For a moment of utter confusion, he thought that he must still be dreaming. The breeze blowing gently through the half-open windows was so warm and humid that it might have escaped from a Turkish bath; yet the car had apparently come to a halt in the midst of a blinding snow-storm.

Morgan blinked, screwed up his eyes, and opened them to reality. This was the first time he had ever seen golden snow...

A dense swarm of butterflies was crossing the road, headed due east in a steady, purposeful migration. Some had been sucked into the car, and fluttered around frantically until Morgan waved them out; many more had plastered themselves on the windscreen. With what were doubtless a few choice Taprobani expletives, the driver emerged and wiped the glass clear; by the time he had finished, the swarm had thinned out to a handful of isolated stragglers.

"Did they tell you about the legend?" he asked, glancing back at his passenger.

"No," said Morgan curtly. He was not at all interested, being anxious to resume his interrupted nap.

"The Golden Butterflies - they're the souls of Kalidasa's warriors - the army he lost at Yakkagala."

Morgan gave an unenthusiastic grunt, hoping that the driver would get the message; but he continued remorselessly.

"Every year, around this time, they head for the Mountain, and they all die on its lower slopes. Sometimes you'll meet them halfway up the cable ride, but that's the highest they get. Which is lucky for the Vihara."

"The Vihara?" asked Morgan sleepily.

"The Temple. If they ever reach it, Kalidasa will have conquered, and the bhikkus - the monks - will have to leave. That's the prophecy - it's carved on a stone slab in the Ranapura Museum. I can show it to you."

"Some other time," said Morgan hastily, as he settled back into the padded seat. But it was many kilometres before he could doze off again, for there was something haunting about the image that the driver had conjured up.

He would remember it often in the months ahead - when waking, and in moments of stress or crisis. Once again he would be immersed in that golden snowstorm, as the doomed millions spent their energies in a vain assault upon the mountain and all that it symbolised.

Even now, at the very beginning of his campaign, the image was too close for comfort.

19. By the Shores of Lake Saladin

Almost all the Alternative History computer simulations suggest that the Battle of Tours (AD 732) was one of the crucial disasters of mankind. Had Charles Martel been defeated, Islam might have resolved the internal differences that were tearing it apart and gone on to conquer Europe. Thus centuries of Christian barbarism would have been avoided, the Industrial Revolution would have started almost a thousand years earlier, and by now we would have reached the nearer stars instead of merely the further planets...

But fate ruled otherwise, and the armies of the Prophet turned back into Africa. Islam lingered on, a fascinating fossil, until the end of the twentieth century. Then, abruptly, it was dissolved in oil...

(Chairman's Address: Toynbee Bi-centennial Symposium, London, 2089.)

"Did you know," said Sheik Farouk Abdullah, "that I have now appointed myself Grand Admiral of the Sahara Fleet?"

"It wouldn't surprise me, Mr. President," Morgan answered, as he gazed out across the sparkling blue expanse of Lake Saladin. "If it's not a naval secret, how many ships do you have?"

"Ten at the moment. The largest is a thirty-metre hydroskimmer run by the Red Crescent; it spends every weekend rescuing incompetent sailors. My people still aren't much good on the water - look at that idiot trying to tack! After all, two hundred years really isn't long enough to switch from camels to boats."

"You had Cadillacs and Rolls-Royces in between. Surely that should have eased the transition."

"And we still have them; my great-great-great-grandfather's Silver Ghost is just as good as new. But I must be fair - it's the visitors who get into trouble, trying to cope with our local winds. We stick to power-boats. And next year I'm getting a submarine guaranteed to reach the lake's maximum depth of 78 metres."

"Whatever for?"

"For they tell us that the Erg was full of archaeological treasures. Of course, no-one bothered about them before it was flooded."

It was no use trying to hurry the President of ANAR - the Autonomous North African Republic - and Morgan knew better than to attempt it. Whatever the Constitution might say, Sheik Abdullah controlled more power and wealth than almost any single individual on earth. Even more to the point, he understood the uses of both.

He came from a family that was not afraid to take risks, and very seldom had cause to regret them. Its first and most famous gamble - which had incurred the hatred of the whole Arab world for almost half a century - was the investment of

its abundant petro-dollars in the science and technology of Israel. That farsighted act had led directly to the mining of the Red Sea, the defeat of the deserts, and, very much later, to the Gibraltar Bridge.

"I don't have to tell you, Van," said the Sheik at last, "how much your new project fascinates me. And after all that we went through together while the Bridge was being built, I know that you could do it - given the resources."

"Thank you."

"But I have a few questions. I'm still not clear why there's Midway Station - and why it's at a height of twenty-five thousand kilometres."

"Several reasons. We needed a major power plant at about that level, which would involve fairly massive construction there in any case. Then it occurred to us that seven hours was too long to stay cooped up in a rather cramped cabin, and splitting the journey gave a number of advantages. We shouldn't have to feed the passengers in transit-they could eat and stretch their legs at the Station. We could also optimise the vehicle design; only the capsules on the lower section would have to be streamlined. Those on the upper run could be much simpler and lighter. The Midway Station would not only serve as a transfer point, but as an operations and control center and ultimately, we believe, as a major tourist attraction and resort in its own right."

"But it's not midway! It's almost - ah - two-thirds of the distance up to stationary orbit."

"True; the mid-point would be at eighteen thousand, not twenty-five. But there's another factor - safety. If the section above is severed, the Midway Station won't crash back to Earth."

"Why not?"

"It will have enough momentum to maintain a stable orbit. Of course, it will fall earthward, but it will always remain clear of the atmosphere. So it will be perfectly safe - it will simply become a space station, moving in a ten-hour, elliptical orbit. Twice a day it will be right back where it started from, and eventually it could be reconnected. In theory, at least..."

"And in practice?"

"Oh, I'm sure it could be done. Certainly the people and equipment on the station could be saved. But we wouldn't have even that option if we established it at a lower altitude. Anything falling from below the twenty-five thousand kilometre limit hits the atmosphere and burns up in five hours, or less."

"Would you propose advertising this fact to passengers on the Earth-Midway run?"

"We hope they would be too busy admiring the view to worry about it."

"You make it sound like a scenic elevator."

"Why not? Except that the tallest scenic ride on earth only goes up a mere three kilometres! We're talking about something ten thousand times higher."

There was a considerable pause while Sheik Abdullah thought this over.

"We missed an opportunity," he said at last. "We could have had five-kilometre scenic rides up the piers of the Bridge."

"They were in the original design, but we dropped them for the usual reason - economy."

"Perhaps we made a mistake; they could have paid for themselves. And I've just realised something else. If this - hyperfilament - had been available at the time I suppose the Bridge could have been built for half the cost."

"I wouldn't lie to you, Mr. President. Less than a fifth. But construction would have been delayed more than twenty years, so you haven't lost by it."

"I must talk that over with my accountants. Some of them still aren't convinced it was a good idea, even though the traffic growth rate is ahead of projection. But I keep telling them that money isn't everything - the Republic needed the Bridge psychologically and culturally, as well as economically. Did you know that 18 percent of the people who drive across it do so just because it's there, not for any other reason? And then they go straight back again, despite having to pay the toll both ways."

"I seem to recall," said Morgan dryly, "giving you similar arguments, a long time ago. You weren't easy to convince."

"True. I remember that the Sydney Opera House was your favourite example. You liked to point out how many times that had paid for itself - even in hard cash, let alone prestige."

"And don't forget the Pyramids."

The Sheik laughed. "What did you call them? The best investment in the history of mankind?"

"Precisely. Still paying tourist dividends after four thousand years."

"Hardly a fair comparison, though. Their running costs don't compare with those of the Bridge much less your proposed Tower's."

"The Tower may last longer than the Pyramids. It's in a far more benign environment."

"That's a very impressive thought. You really believe that it will operate for several thousand years?"

"Not in its original form, of course. But in principle, yes. Whatever technical developments the future brings, I don't believe there will ever be a more efficient, more economical way of reaching Space. Think of it as another bridge. But this time a bridge to the stars or at least to the planets."

"And once again you'd like us to help finance it. We'll still be paying for the last bridge for another twenty years. It's not as if your space elevator was on our territory, or was of direct importance to us."

"But I believe it is, Mr. President. Your republic is a part of the terran economy, and the cost of space transportation is now one of the factors limiting its growth. If you've looked at those estimates for the 50's and 60's..."

"I have - I have. Very interesting. But though we're not exactly poor, we couldn't raise a fraction of the funds needed. Why, it would absorb the entire Gross World Product for a couple of years!"

"And pay it back every fifteen, for ever afterwards."

"If your projections are correct."

"They were, for the Bridge. But you're right, of course, and I don't expect ANAR to do more than start the ball rolling. Once you've shown your interest, it will be that much easier to get other support."

"Such as?"

"The World Bank. The Planetary banks. The Federal government."

"And your own employers, the Terran Construction Corporation? What are you really up to, Van?"

Here it comes, thought Morgan, almost with a sigh of relief. Now at last he could talk frankly with someone he could trust, someone who was too big to be involved in petty bureaucratic intrigues - but who could thoroughly appreciate their finer points.

"I've been doing most of this work in my own time I'm on vacation right now. And incidentally, that's just how the Bridge started! I don't know if I ever told you that I was once officially ordered to forget it... I've learned a few lessons in the past fifteen years."

"This report must have taken a good deal of computer time. Who paid for that?"

"Oh, I have considerable discretionary funds. And my staff is always doing studies that nobody else can understand. To tell the truth, I've had quite a little team playing with the idea for several months. They're so enthusiastic that they spend most of their free time on it as well. But now we have to commit ourselves or abandon the project."

"Does your esteemed Chairman know about this?"

Morgan smiled, without much humour. "Of course not, and I don't want to tell him until I've worked out all the details."

"I can appreciate some of the complications," said the President shrewdly. "One of them, I imagine, is ensuring that Senator Collins doesn't invent it first."

"He can't do that - the idea is two hundred years old. But he, and a lot of other people, could slow it down. I want to see it happen in my lifetime."

"And, of course, you intend to be in charge... Well, what exactly would you like us to do?"

"This is merely one suggestion, Mr. President - you may have a better idea. Form a consortium - perhaps including the Gibraltar Bridge Authority, the Suez and Panama Corporations, the English Channel Company, the Bering Dam

Corporation. Then, when it's all wrapped up, approach TCC with a request to do a feasibility study. At this stage, the investment will be negligible."

"Meaning?"

"Less than a million. Especially as I've already done 80 percent of the work."

"And then?"

"Thereafter, with your backing, Mr. President, I can play it by ear. I might stay with TCC. Or I might resign and join the consortium - call it Astroengineering. It would all depend on circumstances. I would do whatever seemed best for the project."

"That seems a reasonable approach. I think we can work something out."

"Thank you, Mr. President," Morgan answered with heartfelt sincerity. "But there's one annoying roadblock we have to tackle at once - perhaps even before we set up the consortium. We have to go to the World Court, and establish jurisdiction over the most valuable piece of real estate on Earth."

20. The Bridge that Danced

Even in this age of instantaneous communications and swift global transport, it was convenient to have a place that one could call one's office. Not everything could be stored in patterns of electronic charges; there were still such items as good old-fashioned books, professional certificates, awards and honours, engineering models, samples of material, artists' rendering of projects (not as accurate as a computer's, but very ornamental), and of course the wall-to-wall carpet which every senior bureaucrat needed to soften the impact of external reality.

Morgan's office, which he saw on the average ten days per month, was on the sixth or LAND floor of the sprawling Terran Construction Corporation Headquarters in Nairobi. The floor below was SEA, that above it ADMINISRATI0N- meaning Chairman Collins and his empire. The architect, in a fit of naïve symbolism, had devoted the top floor to SPACE. There was even a small observatory on the roof, with a thirty-centimetre telescope that was always out of order, because it was only used during office parties, and frequently for most non-astronomical purposes. The upper rooms of the Triplanetary Hotel, only a kilometre away, were a favourite target, as they often held some very strange forms of life - or at any rate of behaviour.

As Morgan was in continuous touch with his two secretaries one human, the other electronic - he expected no surprises when he walked into the office after the brief flight from ANAR. By the standards of an earlier age, his was an extraordinarily small organisation. He had less than three hundred men and women under his direct control; but the computing and information-processing power at their command could not be matched by the merely human population of the entire planet.

"Well, how did you get on with the Sheik?" asked Warren Kingsley, his deputy and long time friend, as soon as they were alone together.

"Very well; I think we have a deal. But I still can't believe that we're held up by such a stupid problem. What does the legal department say?"

"We'll definitely have to get a World Court ruling. If the Court agrees that it's a matter of overwhelming public interest, our reverend friends will have to move... though if they decide to be stubborn, there would be a nasty situation. Perhaps you should send a small earthquake to help them make up their minds."

The fact that Morgan was on the board of General Tectonics was an old joke between him and Kingsley; but GT - perhaps fortunately - had never found a way of controlling and directing earthquakes, nor did it ever expect to do so. The best that it could hope for was to predict them, and to bleed off their energies harmlessly before they could do major damage. Even here, its record of success was not much better than 75 percent.

"A nice idea," said Morgan, "I'll think it over. Now, what about our other problem?"

"All set to go - do you want it now?"

"O.K. - let's see the worst."

The office windows darkened, and a grid of glowing lines appeared in the centre of the room.

"Watch this, Van," said Kingsley. "Here's the regime that gives trouble."

Rows of letters and numbers materialised in the empty air - velocities, payloads, accelerations, transit times - Morgan absorbed them at a glance. The globe of the earth, with its circles of longitude and latitude, hovered just above the carpet; and rising from it, to little more than the height of a man, was the luminous thread that marked the position of the orbital tower.

"Five hundred times normal speed; lateral scale exaggeration fifty. Here we go."

Some invisible force had started to pluck at the line of light, drawing it away from the vertical. The disturbance was moving upwards as it mimicked, via the computer's millions of calculations a second, the ascent of a payload through the earth's gravitational field.

"What's the displacement?" asked Morgan, as his eyes strained to follow the details of the simulation.

"Now about two hundred metres. It gets to three before -"

The thread snapped. In the leisurely slow-motion that represented real speeds of thousands of kilometres an hour, the two segments of the severed tower began to curl away from each other - one bending back to earth, the other whipping upwards to space...

But Morgan was no longer fully conscious of this imaginary disaster, existing only in the mind of the computer; superimposed upon it now was the reality that had haunted him for years.

He had seen that two-century-old film at least fifty times, and there were sections that he had examined frame by frame, until he knew every detail by heart. It was, after all, the most expensive movie footage ever shot, at least in peacetime. It had cost the State of Washington several million dollars a minute.

There stood the slim (too slim!) and graceful bridge, spanning the canyon. It bore no traffic, but a single car had been abandoned midway by its driver. And no wonder, for the bridge was behaving as none before in the whole history of engineering.

It seemed impossible that thousands of tons of metal could perform such an aerial ballet; one could more easily believe that the bridge was made of rubber than of steel. Vast, slow undulations, metres in amplitude, were sweeping along the entire width of the span, so that the roadway suspended between the piers twisted back and forth like an angry snake. The wind blowing down the canyon was sounding a note far too low for any human ears to detect, as it hit the natural frequency of the beautiful, doomed structure. For hours, the torsional vibrations had been building up, but no-one knew when the end would come. Already, the protracted death-throes were a testimonial that the unlucky designers could well have foregone.

Suddenly, the supporting cables snapped, flailing upwards like murderous steel whips. Twisting and turning, the roadway pitched into the river, fragments of the structure flying in all directions. Even when projected at normal speed, the final cataclysm looked as if shot in slow motion; the scale of the disaster was so large that the human mind had no basis of comparison. In reality, it lasted perhaps five seconds; at the end of that time, the Tacoma Narrows Bridge had earned an inexpungable place in the history of engineering. Two hundred years later there was a photograph of its last moments on the wall of Morgan's office, bearing the caption "One of our less successful products".

To Morgan that was no joke, but a permanent reminder that the unexpected could always strike from ambush. When the Gibraltar Bridge was being designed, he had gone carefully through von Kármán's classic analysis of the Tacoma Narrows disaster, learning all he could from one of the most expensive mistakes of the past. There had been no serious vibrational problems even in the worst gales that had come roaring in from the Atlantic, though the roadway had moved a hundred metres from the centre line precisely as calculated.

But the space elevator was such a leap forward into the unknown that some unpleasant surprises were a virtual certainty. Wind forces on the atmospheric section were easy to estimate, but it was also necessary to take into account the vibrations induced by the stopping and starting of the payloads - and even, on so enormous a structure, by the tidal effects of the sun and moon. And not only individually, but acting all together; with, perhaps, an occasional earthquake to complicate the picture, in the so-called "worst case" analysis.

"All the simulations, in this tons-of-payload-per-hour regime, give the same result. The vibrations build up until there's a fracture at around five hundred kilometres. We'll have to increase the damping - drastically."

"I was afraid of that. How much do we need?"

"Another ten megatons."

Morgan could take some gloomy satisfaction from the figure. That was very close to the guess he had made, using his engineer's intuition and the mysterious resources of his subconscious. Now the computer had confirmed it; they would have to increase the "anchor" mass in orbit by ten million tons.

Even by terrestrial earth-moving standards, such a mass was hardly trivial; it was equivalent to a sphere of rock about two hundred metres across. Morgan had a sudden image of Yakkagala, as he had last seen it, looming against the Taprobanean sky. Imagine lifting that forty thousand kilometres into space! Fortunately, it might not be necessary; there were at least two alternatives.

Morgan always let his subordinates do their thinking for themselves; it was the only way to establish responsibility, it took much of the load off him - and, on many occasions, his staff had arrived at solutions he might have overlooked.

"What do you suggest, Warren?" he asked quietly.

"We could use one of the lunar freight launchers, and shoot up ten megatons of moon-rock. It would be a long and expensive job, and we'd still need a large space-based operation to catch the material and steer it into final orbit. There would also be a psychological problem -"

"Yes, I can appreciate that; we don't want another San Luiz Domingo -"

San Luiz had been the - fortunately small - South American village that had received a stray cargo of processed lunar metal intended for a low-orbit space station. The terminal guidance had failed, resulting in the first man-made meteor crater - and two hundred and fifty deaths. Ever since that, the population of planet Earth had been very sensitive on the subject of celestial target practice.

"A much better answer is to catch an asteroid; we're running a search for those with suitable orbits, and have found three promising candidates. What we really want is a carbonaceous one - then we can use it for raw material when we set up the processing plant. Killing two birds with one stone."

"A rather large stone, but that's probably the best idea. Forget the lunar launcher - a million 10-ton shots would tie it up for years, and some of them would be bound to go astray. If you can't find a large enough asteroid, we can still send the extra mass up by the elevator itself - though I hate wasting all that energy if it can be avoided."

"It may be the cheapest way. With the efficiency of the latest fusion plants, it will take only twenty dollars' worth of electricity to lift a ton up to orbit."

"Are you sure of that figure?"

"It's a firm quotation from Central Power."

Morgan was silent for a few minutes. Then he said: "The aerospace engineers really are going to hate me." Almost as much, he added to himself, as the Venerable Parakarma.

No - that was not fair. Hate was an emotion no longer possible to a true follower of the Doctrine. What he had seen in the eyes of ex-Doctor Choam Goldberg was merely implacable opposition; but that could be equally dangerous.

21. Judgement

One of Paul Sarath's more annoying specialities was the sudden call, gleeful or gloomy as the case might be, which invariably opened with the words: "Have you heard the news?" Though Rajasinghe had often been tempted to give the general-purpose answer: "Yes - I'm not at all surprised," he had never had the heart to rob Paul of his simple pleasure.

"What is it this time?" he answered, without much enthusiasm.

"Maxine's on Global Two, talking to Senator Collins. I think our friend Morgan is in trouble. Call you back."

Paul's excited image faded from the Screen, to be replaced a few seconds later by Maxine Duval's, as Rajasinghe switched to the main news channel. She was sitting in her familiar studio, talking to the Chairman of the Terran Construction Corporation, who seemed to be in a mood of barely suppressed indignation - probably synthetic.

"- Senator Collins, now that the World Court ruling has been given -"

Rajasinghe shunted the entire programme to RECORD, with a muttered: "I thought that wasn't until Friday." As he turned off the sound and activated his private link with ARISTOTLE, he exclaimed, "My God, it is Friday!"

As always, Ari was on line at once.

"Good morning, Raja. What can I do for you?"

That beautiful, dispassionate voice, untouched by human glottis, had never changed in the forty years that he had known it. Decades - perhaps centuries - after he was dead, it would be talking to other men just as it had spoken to him. (For that matter, how many conversations was it having at this very moment?) Once, this knowledge had depressed Rajasinghe; now it no longer mattered. He did not envy ARISTOTLE'S immortality.

"Good morning, Ari, I'd like today's World Court ruling on the case Astroengineering Corporation versus the Sri Kanda Vihara. The summary will do - let me have the full printout later."

"Decision 1. Lease of temple site confirmed in perpetuity under Taprobanean and World Law, as codified 2085. Unanimous filing."

"Decision 2. The construction of the proposed Orbital Tower with its attendant noise, vibration and impact upon a site of great historic and cultural importance would constitute a private nuisance, meriting an injunction under the Law of Torts. At this stage, public interest not of sufficient merit to affect the issue. Ruling 4 to 2, one abstention."

"Thank you, Ari - cancel printout - I won't need it. Goodbye." Well, that was that, just as he had expected. Yet he did not know whether to be relieved or disappointed.

Rooted as he was in the past, he was glad that the old traditions were cherished and protected. If one thing had been learned from the bloody history of mankind, it was that only individual human beings mattered: however eccentric their beliefs might be, they must be safeguarded, so long as they did not conflict with wider but equally legitimate interests. What was it that the old poet had said? "There is no such thing as the State." Perhaps that was going a little too far; but it was better than the other extreme.

At the same time, Rajasinghe felt a mild sense of regret. He had half convinced himself (was this merely co-operating with the inevitable?) that Morgan's fantastic enterprise might be just what was needed to prevent Taprobane (and perhaps the whole world, though that was no longer his responsibility) from sinking into a comfortable, self-satisfied decline. Now the Court had closed that particular avenue, at least for many years.

He wondered what Maxine would have to say on the subject, and switched over to delayed playback. On Global Two, the News Analysis channel (sometimes referred to as the Land of Talking Heads), Senator Collins was still gathering momentum.

"- undoubtedly exceeding his authority and using the resources of his division on projects which did not concern it."

"But surely, Senator, aren't you being somewhat legalistic? As I understand it, hyperfilament was developed for construction purposes, especially bridges. And isn't this a kind of bridge? I've heard Dr. Morgan use that analogy, though he also calls it a tower."

"You're being legalistic now, Maxine. I prefer the name 'space elevator'. And you're quite wrong about hyperfilament. It's the result of two hundred years of aerospace research. The fact that the final breakthrough came in the Land Division of my - ah - organisation is irrelevant, though naturally I'm proud that my scientists were involved."

"You consider that the whole project should be handed over to the Space Division?"

"What project? This is merely a design study one of hundreds that are always going on in TCC. I never hear about a fraction of them, and I don't want to - until they reach the stage when some major decision has to be made."

"Which is not the case here?"

"Definitely not. My space transportation experts say that they can handle all projected traffic increases - at least for the foreseeable future."

"Meaning precisely?"

"Another twenty years."

"And what happens then? The Tower will take that long to build, according to Dr. Morgan. Suppose it isn't ready in time?"

"Then we'll have something else. My staff is looking into all the possibilities, and it's by no means certain that the space elevator is the right answer."

"The idea, though, is fundamentally sound?"

"It appears to be, though further studies are required."

"Then surely you should be grateful to Dr. Morgan for his initial work."

"I have the utmost respect for Dr. Morgan. He is one of the most brilliant engineers in my organization - if not in the world."

"I don't think, Senator, that quite answers my question."

"Very well; I am grateful to Dr. Morgan for bringing this matter to our notice. But I do not approve of the way in which he did it. If I may be blunt, he tried to force my hand."

"How?"

"By going outside my organization - his organization - and thus showing a lack of loyalty. As a result of his manoeuvrings, there has been an adverse World Court decision, which inevitably has provoked much unfavourable comment. In the circumstances, I have had no choice but to request - with the utmost regret - that he tender his resignation."

"Thank you, Senator Collins. As always, it's been a pleasure talking to you."

"You sweet liar," said Rajasinghe, as he switched off and took the call that had been flashing for the last minute.

"Did you get it all?" asked Professor Sarath. "So that's the end of Dr. Vannevar Morgan."

Rajasinghe looked thoughtfully at his old friend for a few seconds.

"You were always fond of jumping to conclusions, Paul. How much would you care to bet?"

III - THE BELL

22. Apostate

Driven to despair by his fruitless attempts to understand the Universe, the sage Devadasa finally announced in exasperation

ALL STATEMENTS THAT CONTAIN THE WORD GOD ARE FALSE.

Instantly, his least-favourite disciple Somasiri replied "The sentence I am now speaking contains the word God. I fail to see, Oh Noble Master, how that simple statement can be false."

Devadasa considered the matter for several Poyas. Then he answered, this time with apparent satisfaction:

ONLY STATEMENTS THAT DO NOT CONTAIN THE WORD GOD CAN BE TRUE.

After a pause barely sufficient for a starving mongoose to swallow a millet seed, Somasiri replied: "If this statement applies to itself; Oh Venerable One, it cannot be true, because it contains the word God. But if it is not true -"

At this point, Devadasa broke his begging-bowl upon Somasiri's head, and should therefore be honoured as the true founder of Zen.

(From a fragment of the Culavamsa, as yet undiscovered)

In the late afternoon, when the stairway was no longer blasted by the full fury of the sun, the Venerable Parakarma began his descent. By nightfall he would reach the highest of the pilgrim rest-houses; and by the following day he would have returned to the world of men.

The Maha Thero had given neither advice nor discouragement, and if he was grieved by his colleague's departure he had shown no sign. He had merely intoned, "All things are impermanent", clasped his hands, and given his blessing.

The Venerable Parakarma, who had once been Dr. Choam Goldberg, and might be so again, would have had great difficulty in explaining all his motives. "Right action" was easy to say; it was not easy to discover.

At the Sri Kanda Maha Vihara he had found peace of mind - but that was not enough. With his scientific training, he was no longer content to accept the Order's ambiguous attitude towards God; such indifference had come at last to seem worse than outright denial.

If such a thing as a rabbinical gene could exist, Dr. Goldberg possessed it. Like many before him, Goldberg-Parakarma had sought God through mathematics, undiscouraged even by the bombshell that Kurt Gödel, with the discovery of undecidable propositions, had exploded early in the Twentieth Century. He could not understand how anyone could contemplate the dynamic asymmetry of Euler's profound, yet beautifully simple,

e^(pi * i) + I = 0

without wondering if the universe was the creation of some vast intelligence.

Having first made his name with a new cosmological theory that had survived almost ten years before being refuted, Goldberg had been widely acclaimed as another Einstein or N'goya. In an age of ultra-specialisation, he had also managed to make notable advances in aero and hydrodynamics - long regarded as dead subjects, incapable of further surprises.

Then, at the height of his powers, he had experienced a religious conversion not unlike Pascal's, though without so many morbid undertones. For the next decade, he had been content to lose himself in saffron anonymity, focusing his brilliant mind upon questions of doctrine and philosophy. He did not regret the interlude, and he was not even sure that he had abandoned the Order; one day, perhaps, this great stairway would see him again. But his God-given talents were reasserting themselves; there was massive work to be done, and he needed tools that could not be found on Sri Kanda - or even, for that matter, on Earth itself.

He felt little hostility, now, towards Vannevar Morgan. However inadvertently, the engineer had ignited the spark; in his blundering way, he too was an agent of God. Yet at all costs the temple must be protected. Whether or not the Wheel of Fate ever returned him to its tranquillity, Parakarma was implacably resolved upon that.

And so, like a new Moses bringing down from the mountain laws that would change the destinies of men, the Venerable Parakarma descended to the world he had once renounced. He was blind to the beauties of land and sky that were all around him; for they were utterly trivial compared to those that he alone could see, in the armies of equations that were marching through his mind.

23. Moondozer

"Your trouble, Dr. Morgan," said the man in the wheelchair, "is that you're on the wrong planet."

"I can't help thinking," retorted Morgan, looking pointedly at his visitor's life-support system, "that much the same may be said of you."

The Vice-President (Investments) of Narodny Mars gave an appreciative chuckle.

"At least I'm here only for a week - then it's back to the Moon, and a civilised gravity. Oh, I can walk if I really have to: but I prefer otherwise."

"If I may ask, why do you come to Earth at all?"

"I do so as little as possible, but sometimes one has to be on the spot. Contrary to general belief; you can't do everything by remotes. I'm sure you are aware of that."

Morgan nodded; it was true enough. He thought of all the times when the texture of some material, the feel of rock or soil underfoot, the smell of a jungle, the sting of spray upon his face, had played a vital role in one of his projects. Some day, perhaps even these sensations could be transferred by electronics-indeed, it had already been done so crudely, on an experimental basis, and at enormous cost. But there was no substitute for reality; one should beware of imitations.

"If you've visited Earth especially to meet me," Morgan replied, "I appreciate the honour. But if you're offering me a job on Mars, you're wasting your time. I'm enjoying my retirement, meeting friends and relatives I haven't seen for years, and I've no intention of starting a new career."

"I find that surprising; after all, you're only 52. How do you propose to occupy your time?"

"Easily. I could spend the rest of my life on any one of a dozen projects. The ancient engineers - the Romans, the Greeks, the Incas - they've always fascinated me, and I've never had time to study them. I've been asked to write and deliver a Global University course on design science. There's a text-book I'm commissioned to write on advanced structures. I want to develop some ideas about the use of active elements to correct dynamic loads - winds, earthquakes, and so forth - I'm still consultant for General Tectonics. And I'm preparing a report on the administration of TCC."

"At whose request? Not, I take it, Senator Collins'?"

"No," said Morgan, with a grim smile. "I thought it would be - useful. And it helps to relieve my feelings."

"I'm sure of it. But all these activities aren't really creative. Sooner or later they'll pall - like this beautiful Norwegian scenery. You'll grow tired of looking at lakes and fir trees, just as you'll grow tired of writing and talking. You are the sort of man who will never be really happy, Dr. Morgan, unless you are shaping your universe."

Morgan did not reply. The prognosis was much too accurate for comfort.

"I suspect that you agree with me. What would you say if I told you that my Bank was seriously interested in the space elevator project?"

"I'd be sceptical. When I approached them, they said it was a fine idea, but they couldn't put any money into it at this stage. All available funds were needed for the development of Mars. It's the old story - we'll be glad to help you, when you don't need any help."

"That was a year ago; now there have been some second thoughts. We'd like you to build the space elevator - but not on Earth. On Mars. Are you interested?"

"I might be. Go on."

"Look at the advantages. Only a third of the gravity, so the forces involved are correspondingly smaller. The synchronous orbit is also closer - less than half the altitude here. So at the very start, the engineering problems are enormously reduced. Our people estimate that the Mars system would cost less than a tenth of the Terran one."

"That's quite possible, though I'd have to check it."

"And that's just the beginning. We have some fierce gales on Mars, despite our thin atmosphere - but mountains that get completely above them. Your Sri Kanda is only five kilometres high. We have Mons Pavonis - twenty-one kilometres, and exactly on the equator! Better still, there are no Martian monks with long-term leases sitting on the summit... And there's one other reason why Mars might have been designed for a space elevator. Deimos is only three thousand kilometres above the stationary orbit. So we already have a couple of million megatons sitting in exactly the right place for the anchor."

"That will present some interesting problems in synchronisation, but I see what you mean. I'd like to meet the people who worked all this out."

"You can't, in real time. They're all on Mars. You'll have to go there."

"I'm tempted, but I still have a few other questions."

"Go ahead."

"Earth must have the elevator, for all the reasons you doubtless know. But it seems to me that Mars could manage without it. You have only a fraction of our space traffic, and a much smaller projected growth rate. Frankly, it doesn't make a great deal of sense to me."

"I was wondering when you'd ask."

"Well, I'm asking."

"Have you heard of Project Eos?"

"I don't think so."

"Eos - Greek for Dawn - the plan to rejuvenate Mars."

"Oh, of course I know about that. It involves melting the polar caps, doesn't it?"

"Exactly. If we could thaw out all that water and CO_2 ice, several things would happen. The atmospheric density would increase until men could work in the open without spacesuits; at a later stage, the air might even be made breathable. There would be running water, small seas - and, above all, vegetation - the beginnings of a carefully planned biota. In a couple of centuries, Mars could be another Garden of Eden. It's the only planet in the solar system we can transform with known technology: Venus may always be too hot."

"And where does the elevator come into this?"

"We have to lift several million tons of equipment into orbit. The only practical way to heat up Mars is by solar mirrors, hundreds of kilometres

across. And we'll need them permanently - first to melt the ice-caps, and later to maintain a comfortable temperature."

"Couldn't you get all this material from your asteroid mines?"

"Some of it, of course. But the best mirrors for the job are made of sodium, and that's rare in space. We'll have to get it from the Tharsis salt-beds - right by the foothills of Pavonis, luckily enough."

"And how long will all this take?"

"If there are no problems, the first stage could be complete in fifty years. Maybe by your hundredth birthday, which the actuaries say you have a thirty-nine percent chance of seeing."

Morgan laughed.

"I admire people who do a thorough job of research."

"We wouldn't survive on Mars unless we paid attention to detail."

"Well, I'm favourably impressed, though I still have a great many reservations. The financing, for example -"

"That's my job, Dr. Morgan. I'm the banker. You're the engineer."

"Correct, but you seem to know a good deal about engineering, and I've had to learn a lot of economics - often the hard way. Before I'd even consider getting involved in such a project, I should want a detailed budget breakdown -"

"Which can be provided -"

"- and that would just be the start. You may not realise that there's still a vast amount of research involved in half-a-dozen fields - mass production of the hyperfilament material, stability and control problems - I could go on all night."

"That won't be necessary; our engineers have read all your reports. What they are proposing is a small-scale experiment that will settle many of the technical problems, and prove that the principle is sound -"

"There's no doubt about that."

"I agree, but it's amazing what a difference a little practical demonstration can make. So this is what we would like you to do. Design the minimum possible system - just a wire with a payload of a few kilogrammes. Lower it from synchronous orbit to Earth - yes, Earth. If it works here, it will be easy on Mars. Then run some thing up it just to show that rockets are obsolete. The experiment will be relatively cheap, it will provide essential information and basic training - and, from our point of view, it will save years of argument. We can go to the Government of Earth, the Solar Fund, the other interplanetary banks - and just point to the demonstration."

"You really have worked all this out. When would you like my answer?"

"To be honest, in about five seconds. But obviously, there's nothing urgent about the matter. Take as long as seems reasonable."

"Very well. Give me your design studies, cost analyses, and all the other material you have. Once I've been through them, I'll let you have my decision in - oh, a week at the most."

"Thank you. Here's my number. You can get me at any time."

Morgan slipped the banker's ident card into the memory slot of his communicator and checked the ENTRY CONFIRMED on the visual display. Before he had returned the card, he had already made up his mind. Unless there was a fundamental flaw in the Martian analysis - and he would bet a large sum that it was sound - his retirement was over. He had often noted, with some amusement, that whereas he frequently thought long and hard over relatively trivial decisions, he had never hesitated for a moment at the major turning-points of his career. He had always known what to do, and had seldom been wrong.

And yet, at this stage in the game, it was better not to invest too much intellectual or emotional capital into a project that might still come to nothing. After the banker had rolled out on the first stage of his journey back to Port Tranquillity, via Oslo and Gagarin, Morgan found it impossible to settle down to any of the activities he had planned for the long northern evening; his mind was in a turmoil, scanning the whole spectrum of suddenly changed futures.

After a few minutes of restless pacing, he sat down at his desk and began to list priorities in a kind of reverse order, starting with the commitments he could most easily shed. Before long, however, he found it impossible to concentrate on such routine matters. Far down in the depths of his mind something was nagging at him, trying to attract his attention. When he tried to focus upon it, it promptly eluded him, like a familiar but momentarily forgotten word.

With a sigh of frustration Morgan pushed himself away from the desk, and walked out on to the verandah running along the western face of the hotel. Though it was very cold, the air was quite still and the sub-zero temperature was more of a stimulus than a discomfort. The sky was a blaze of stars, and a yellow crescent moon was sinking down towards its reflection in the fjord, whose surface was so dark and motionless that it might have been a sheet of polished ebony.

Thirty years ago he had stood at almost this same spot, with a girl whose very appearance he could no longer clearly recall. They had both been celebrating their first degrees, and that had been really all they had in common. It had not been a serious affair; they were young, and enjoyed each other's company - and that had been enough. Yet somehow that fading memory had brought him back to Trollshavn Fjord at this crucial moment of his life. What would the young student of twenty-two have thought, could he have known how his footsteps would lead him back to this place of remembered pleasures, three decades in his future?

There was scarcely a trace of nostalgia or self-pity in Morgan's reverie- only a kind of wistful amusement. He had never for an instant regretted the fact that he and Ingrid had separated amicably, without even considering the usual one-year trial contract. She had gone on to make three other men moderately miserable before finding herself a job with the Lunar Commission, and Morgan had lost track of her. Perhaps, even now, she was up there on that shining crescent, whose colour almost matched her golden hair.

So much for the past. Morgan turned his thoughts to the future. Where was Mars? He was ashamed to admit that he did not even know if it was visible tonight. As he ran his eye along the path of the ecliptic, from the Moon to the dazzling beacon of Venus and beyond, he saw nothing in all that jewelled profusion that he could certainly identify with the red planet. It was exciting to think that in the not-too-distant future he - who had never even travelled beyond lunar orbit! - might be looking with his own eyes at those magnificent crimson landscapes, and watching the tiny moons pass swiftly through their phases.

In that moment the dream collapsed. Morgan stood for a moment paralysed, then dashed back into the hotel, forgetting the splendour of the night.

There was no general purpose console in his room, so he had to go down to the lobby to get the information he required. As luck would have it, the cubicle was occupied by an old lady who took so long to find what she wanted that Morgan almost pounded on the door. But at last the sluggard left with a mumbled apology, and Morgan was face to face with the accumulated art and knowledge of all mankind.

In his student days, he had won several retrieval championships, racing against the clock while digging out obscure items of information on lists prepared by ingeniously sadistic judges. ("What was the rainfall in the capital of the world's smallest national state on the day when the second largest number of home runs was scored in college baseball?" was one that he recalled with particular affection.) His skill had improved with years, and this was a perfectly straightforward question. The display came up in thirty seconds, in far more detail than he really needed.

Morgan studied the screen for a minute, then shook his head in baffled amazement.

"They couldn't possibly have overlooked that!" he muttered. "But what can they do about it?"

Morgan pressed the HARD COPY button, and carried the thin sheet of paper back to his room for more detailed study. The problem was so stunningly, appallingly obvious that he wondered if he had overlooked some equally obvious solution and would be making a fool of himself if he raised the matter. Yet there was no possible escape...

He looked at his watch: already after midnight. But this was something he had to settle at once.

To Morgan's relief, the banker had not pressed his DON'T DISTURB button. He replied immediately, sounding a little surprised.

"I hope I didn't wake you up," said Morgan, not very sincerely.

"No - we're just about to land at Gagarin. What's the problem?"

"About ten teratons, moving at two kilometres a second. The inner moon, Phobos. It's a cosmic bulldozer, going past the elevator every eleven hours. I've not worked out the exact probabilities, but a collision is inevitable every few days."

There was silence for a long time from the other end of the circuit. Then the banker said: "I could have thought of that. So obviously, someone has the answer. Perhaps we'll have to move Phobos."

"Impossible: the mass is far too great."

"I'll have to call Mars. The time delay's twelve minutes at the moment. I should have some sort of answer within the hour."

I hope so, Morgan told himself. And it had better be good... that is, if I really want this job.

24. The Finger of God

Dendrobium macarthiae usually flowered with the coming of the south-west monsoon, but this year it was early. As Johan Rajasinghe stood in his orchid house, admiring the intricate violet-pink blossoms, he remembered that last season he had been trapped by a torrential downpour for half-an-hour while examining the first blooms.

He looked anxiously at the sky; no, there was little danger of rain. It was a beautiful day, with thin, high bands of cloud moderating the fierce sunlight. But that was odd.

Rajasinghe had never seen anything quite like it before. Almost vertically overhead, the parallel lanes of cloud were broken by a circular disturbance. It appeared to be a tiny cyclonic storm, only a few kilometres across, but it reminded Rajasinghe of something completely different - a knot-hole breaking through the grain in a smoothly planed board. He abandoned his beloved orchids and stepped outside to get a better view of the phenomenon. Now he could see that the small whirlwind was moving slowly across the sky, the track of its passage clearly marked by the distortion of the cloud lanes.

One could easily imagine that the finger of God was reaching down from heaven, tracing a furrow through the clouds. Even Rajasinghe, who understood the basics of weather control, had no idea that such precision was now possible; but he could take a modest pride in the fact that, almost forty years ago, he had played his part in its achievement.

It had not been easy to persuade the surviving superpowers to relinquish their orbital fortresses and hand them over to the Global Weather Authority, in what was - if the metaphor could be stretched that far - the last and most dramatic example of beating swords into ploughshares. Now the lasers that had once threatened mankind directed their beams into carefully selected portions of the atmosphere, or onto heat-absorbing target areas in remote regions of the earth. The energy they contained was trifling, compared to that of the smallest storm; but so is the energy of the falling stone that triggers an avalanche, or the single neutron that starts a chain reaction.

Beyond that, Rajasinghe knew nothing of the technical details, except that they involved networks of monitoring satellites, and computers that held within their electronic brains a complete model of the earth's atmosphere, land surfaces and seas. He felt rather like an awestruck savage, gaping at the

wonders of some advanced technology, as he watched the little cyclone move purposefully into the west, until it disappeared below the graceful line of palms just inside the ramparts of the Pleasure Gardens.

Then he glanced up at the invisible engineers and scientists, racing round the world in their man-made heavens.

"Very impressive," he said. "But I hope you know exactly what you're doing."

25. Orbital Roulette

"I should have guessed," said the banker ruefully, "that it would have been in one of those technical appendices that I never looked at. And now you've seen the whole report, I'd like to know the answer. You've had me worrying, ever since you raised the problem."

"It's brilliantly obvious," Morgan answered, "and I should have thought of it myself."

And I would have done - eventually - he told himself, with a fair degree of confidence. In his mind's eye he saw again those computer simulations of the whole immense structure, twanging like a cosmic violin string, as the hours-long vibrations raced from earth to orbit and were reflected back again. And superimposed on that he replayed from memory, for the hundredth time, the scratched movie of the dancing bridge. There were all the clues he needed.

"Phobos sweeps past the tower every eleven hours and ten minutes, but luckily it isn't moving in exactly the same plane - or we'd have a collision every time it went round. It misses on most revolutions and the danger times are exactly predictable - to a thousandth of a second, if desired. Now the elevator, like any piece of engineering, isn't a completely rigid structure. It has natural vibration periods, which can be calculated almost as accurately as planetary orbits. So what your engineers propose to do is to tune the elevator, so that its normal oscillations - which can't be avoided anyway - always keep it clear of Phobos. Every time the satellite passes by the structure, it isn't there - it's sidestepped the danger zone by a few kilometres."

There was a long pause from the other end of the circuit.

"I shouldn't say this," said the Martian at last, "but my hair is standing on end."

Morgan laughed. "Put as bluntly as this, it does sound like - what was it called - Russian Roulette. But remember, we're dealing with exactly predictable movements. We always know where Phobos will be, and we can control the displacement of the tower, simply by the way we schedule traffic along it."

"Simply," thought Morgan, was hardly the right word, but anyone could see that it was possible. And then an analogy flashed into his mind that was so perfect, yet so incongruous, that he almost burst into laughter. No - it would not be a good idea to use it on the banker.

Once again, he was back at the Tacoma Narrows Bridge, but this time in a world of fantasy. There was a ship that had to sail beneath it, on a perfectly regular schedule. Unfortunately, the mast was a metre too tall.

No problem. Just before it was due to arrive, a few heavy trucks would be sent racing across the bridge, at intervals carefully calculated to match its resonant frequency. A gentle wave would sweep along the roadway from pier to pier, the crest timed to coincide with the arrival of the ship. And so the mast-head would glide beneath, with whole centimetres to spare... On a scale thousands of times larger, this was how Phobos would miss the structure towering out into space from Mons Pavonis.

"I'm glad to have your assurance," said the banker, "but I think I'd do a private check on the position of Phobos before I take a trip."

"Then you'll be surprised to know that some of your bright young people - they're certainly bright, and I'm assuming they're young because of their sheer technical effrontery - want to use the critical periods as a tourist attraction. They think they could charge premium rates for views of Phobos sailing past at arm's length at a couple of thousand kiometres an hour. Quite a spectacle, wouldn't you agree?"

"I prefer to imagine it, but they may be right. Anyway, I'm relieved to hear that there is a solution. I'm also happy to note that you approve of our engineering talent. Does this mean we can expect a decision soon?"

"You can have it now," said Morgan. "When can we start work?"

26. The Night Before Vesak

It was still, after twenty-seven centuries, the most revered day of the Taprobanean calendar. On the May full moon, according to legend, the Buddha had been born, had achieved enlightenment, and had died. Though to most people Vesak now meant no more than that other great annual holiday, Christmas, it was still a time for meditation and tranquillity.

For many years, Monsoon Control had guaranteed that there would be no rain on the nights of Vesak plus and minus one. And for almost as long, Rajasinghe had gone to the Royal City two days before the full moon, on a pilgrimage that annually refreshed his spirit. He avoided Vesak itself; on that day Ranapura was too crowded with visitors, some of whom would be guaranteed to recognise him, and disturb his solitude.

Only the sharpest eye could have noticed that the huge, yellow moon lifting above the bell-shaped domes of the ancient dagobas was not yet a perfect circle. The light it gave was so intense that only a few of the most brilliant satellites and stars were visible in the cloudless sky. And there was not a breath of wind.

Twice, it was said, Kalidasa had stopped on this road, when he had left Ranapura forever. The first halt was at the tomb of Hanuman, the loved companion of his boyhood; and the second was at the Shrine of the Dying Buddha. Rajasinghe had often wondered what solace the haunted king had gathered - perhaps at this

very spot, for it was the best point from which to view the immense figure carved from the solid rock. The reclining shape was so perfectly proportioned that one had to walk right up to it before its real size could be appreciated. From a distance it was impossible to realise that the pillow upon which the Buddha rested his head was itself higher than a man.

Though Rajasinghe had seen much of the world, he knew no other spot so full of peace. Sometimes he felt that he could sit here forever, beneath the blazing moon, wholly unconcerned with all the cares and turmoil of life. He had never tried to probe too deeply into the magic of the Shrine, for fear that he would destroy it, but some of its elements were obvious enough. The very posture of the Enlightened One, resting at last with closed eyes after a long and noble life, radiated serenity. The sweeping lines of the robe were extraordinarily soothing and restful to contemplate; they appeared to flow from the rock, to form waves of frozen stone. And, like the waves of the sea, the natural rhythm of their curves appealed to instincts of which the rational mind knew nothing.

In timeless moments such as this, alone with the Buddha and the almost full moon, Rajasinghe felt that he could understand at last the meaning of Nirvana - that state which can be defined only by negatives. Such emotions as anger, desire, greed no longer possessed any power; indeed, they were barely conceivable. Even the sense of personal identity seemed about to fade away, like a mist before the morning sun.

It could not last, of course. Presently he became aware of the buzzing of insects, the distant barking of dogs, the cold hardness of the stone upon which he was sitting. Tranquillity was not a state of mind which could be sustained for long. With a sigh, Rajasinghe got to his feet and began the walk back to his car, parked a hundred metres outside the temple grounds.

He was just entering the vehicle when he noticed the small white patch, so clearly defined that it might have been painted on the sky, rising over the trees to the west. It was the most peculiar cloud that Rajasinghe had ever seen- a perfectly symmetrical ellipsoid, so sharp-edged that it appeared almost solid. He wondered if someone was flying an airship through the skies of Taprobane; but he could see no fins, and there was no sound of engines.

Then, for a fleeting moment, he had a far wilder fancy. The Starholmers had arrived at last.

But that, of course, was absurd. Even if they had managed to outrun their own radio signals, they could hardly have traversed the whole solar system - and descended into the skies of Earth - without triggering all the traffic radars in existence. The news would have broken hours ago.

Rather to his surprise, Rajasinghe felt a mild sense of disappointment. And now, as the apparition came closer, he could see that it undoubtedly was a cloud, because it was getting slightly frayed around the edges. Its speed was impressive; it seemed to be driven by a private gale, of which there was still no trace here at ground level.

So the scientists of Monsoon Control were at it again, testing their mastery of the winds. What, Rajasinghe wondered, would they think of next?

27. Ashoka Station

How tiny the island looked from this altitude! Thirty-six thousand kilometres below, straddling the equator, Taprobane appeared not much bigger than the moon. The entire country seemed too small a target to hit; yet he was aiming for an area at its centre about the size of a tennis court.

Even now, Morgan was not completely certain of his motives. For the purpose of this demonstration, he could just as easily have operated from Kinte Station and targeted Kilimanjaro or Mount Kenya. The fact that Kinte was at one of the most unstable points along the entire stationary orbit, and was always jockeying to remain over Central Africa, would not have mattered for the few days the experiment would last. For a while he had been tempted to aim at Chimborazo; the Americans had even offered, at considerable expense, to move Columbus Station to its precise longitude. But in the end, despite this encouragement, he had returned to his original objective - Sri Kanda.

It was fortunate for Morgan that, in this age of computer-assisted decisions, even a World Court ruling could be obtained in a matter of weeks. The vihara, of course, had protested. Morgan had argued that a brief scientific experiment, conducted on grounds outside the temple premises, and resulting in no noise, pollution or other form of interference, could not possibly constitute a tort. If he was prevented from carrying it out, all his earlier work would be jeopardised, he would have no way of checking his calculations, and a project vital to the Republic of Mars would receive a severe setback.

It was a very plausible argument, and Morgan had believed most of it himself. So had the judges, by five to two. Though they were not supposed to be influenced by such matters, mentioning the litigious Martians was a clever move. The R.o.M. already had three complicated cases in progress, and the Court was slightly tired of establishing precedents in interplanetary law.

But Morgan knew, in the coldly analytical part of his mind, that his action was not dictated by logic alone. He was not a man who accepted defeat gracefully; the gesture of defiance gave him a certain satisfaction. And yet - at a still deeper level - he rejected this petty motivation; such a schoolboy gesture was unworthy of him. What he was really doing was building up his self-assurance, and re-affirming his belief in ultimate success. Though he did not know how, or when, he was proclaiming to the world - and to the stubborn monks within their ancient walls - "I shall return".

Ashoka Station controlled virtually all communications, meteorology, environmental monitoring and space traffic in the Hindu Cathay region. If it ever ceased to function, a billion lives would be threatened with disaster and, if its services were not quickly restored, death. No wonder that Ashoka had two completely independent sub-satellites, Bhaba and Sarabhai, a hundred kilometres away. Even if some unthinkable catastrophe destroyed all three stations, Kinte and Imhotep to the west or Confucius to the east could take over on an emergency basis. The human race had learned, from harsh experience, not to put all its eggs in one basket.

There were no tourists, vacationers or transit passengers here, so far from Earth; they did their business and sightseeing only a few thousand kilometres out, and left the high geosynchronous orbit to the scientists and engineers - not one of whom had ever visited Ashoka on so unusual a mission, or with such unique equipment.

The key to Operation Gossamer now floated in one of the station's medium-sized docking chambers, awaiting the final check-out before launch. There was nothing very spectacular about it, and its appearance gave no hint of the man-years and the millions that had gone into its development.

The dull grey cone, four metres long and two metres across the base, appeared to be made of solid metal; it required a close examination to reveal the tightly-wound fibre covering the entire surface. Indeed, apart from an internal core, and the strips of plastic interleaving that separated the hundreds of layers, the cone was made of nothing but a tapering hyperfilament thread - forty thousand kilometres of it.

Two obsolete and totally different technologies had been revived for the construction of that unimpressive grey cone. Three hundred years ago, submarine telegraphs had started to operate across the ocean beds; men had lost fortunes before they had mastered the art of coiling thousands of kilometres of cable and playing it out at a steady rate from continent to continent, despite storms and all the other hazards of the sea. Then, just a century later, some of the first primitive guided weapons had been controlled by fine wires spun out as they flew to their targets, at a few hundred kilometres an hour. Morgan was attempting a thousand times the range of those War Museum relics, and fifty times their velocity. However, he had some advantages. His missile would be operating in a perfect vacuum for all but the last hundred kilometres; and its target was not likely to take evasive action.

The Operations Manager, Project Gossamer, attracted Morgan's attention with a slightly embarrassed cough.

"We still have one minor problem, Doctor," she said. "We're quite confident about the lowering - all the tests and computer simulations are satisfactory, as you've seen. It's reeling the filament in again that has Station Safety worried."

Morgan blinked rapidly; he had given little thought to the question. It seemed obvious that winding the filament back again was a trivial problem, compared to sending it out. All that was needed, surely, was a simple power-operated winch, with the special modifications needed to handle such a fine, variable-thickness material. But he knew that in space one should never take anything for granted, and that intuition - especially the intuition of an earth-based engineer - could be a treacherous guide.

Let's see - when the tests are concluded, we cut the earth end and Ashoka starts to wind the filament in. Of course, when you tug - however hard - at one end of a line forty thousand kilometres long, nothing happens for hours. It would take half a day for the impulse to reach the far end, and the system to start moving as a whole. So we keep up the tension - Oh! -

"Somebody did a few calculations," continued the engineer, "and realised that when we finally got up to speed, we'd have several tons heading towards the station at a thousand kilometres an hour. They didn't like that at all."

"Understandably. What do they want us to do?"

"Programme a slower reeling in, with a controlled momentum budget. If the worst comes to the worst, they may make us move off-station to do the wind-up."

"Will that delay the operation?"

"No; we've worked out a contingency plan for heaving the whole thing out of the airlock in five minutes, if we have to."

"And you'll be able to retrieve it easily?"

"Of course."

"I hope you're right. That little fishing line cost a lot of money - and I want to use it again."

But where? Morgan asked himself; as he stared at the slowly waxing crescent Earth. Perhaps it would be better to complete the Mars project first, even if it meant several years of exile. Once Pavonis was fully operational, Earth would have to follow, and he did not doubt that, somehow, the last obstacles would be overcome.

Then the chasm across which he was now looking would be spanned, and the fame that Gustave Eiffel had earned three centuries ago would be utterly eclipsed.

28. The First Lowering

There would be nothing to see for at least another twenty minutes. Nevertheless, everyone not needed in the control hut was already outside, staring up at the sky. Even Morgan found it hard to resist the impulse, and kept edging towards the door.

Seldom more than a few metres from him was Maxine Duval's latest Remote, a husky youth in his late twenties. Mounted on his shoulders were the usual tools of his trade - twin cameras in the traditional "right forward, left backward" arrangement, and above those a small sphere not much larger than a grapefruit. The antenna inside that sphere was doing very clever things, several thousand times a second, so that it was always locked on the nearest comsat despite all the antics of its bearer. And at the other end of that circuit, sitting comfortably in her studio office, Maxine Duval was seeing through the eyes of her distant alter ego and hearing with his ears - but not straining her lungs in the freezing air. This time she had the better part of the bargain; it was not always the case.

Morgan had agreed to the arrangement with some reluctance. He knew that this was an historic occasion, and accepted Maxine's assurance that "my man won't get in the way". But he was also keenly aware of all the things that could go wrong in such a novel experiment - especially during the last hundred kilometres of atmospheric entry. On the other hand, he also knew that Maxine could be trusted to treat either failure or triumph without sensationalism.

Like all great reporters, Maxine Duval was not emotionally detached from the events that she observed. She could give all points of view, neither distorting nor omitting any facts which she considered essential. Yet she made no attempt to conceal her own feelings, though she did not let them intrude. She admired Morgan enormously, with the envious awe of someone who lacked all real creative

ability. Ever since the building of the Gibraltar Bridge she had waited to see what the engineer would do next; and she had not been disappointed. But though she wished Morgan luck, she did not really like him. In her opinion, the sheer drive and ruthlessness of his ambition made him both larger than life and less than human. She could not help contrasting him with his deputy, Warren Kingsley. Now there was a thoroughly nice, gentle person ("And a better engineer than I am," Morgan had once told her, more than half seriously). But no-one would ever hear of Warren; he would always be a dim and faithful satellite of his dazzling primary. As, indeed, he was perfectly content to be.

It was Warren who had patiently explained to her the surprisingly complex mechanics of the descent. At first sight, it appeared simple enough to drop something straight down to the equator from a satellite hovering motionless above it. But astrodynamics was full of paradoxes; if you tried to slow down, you moved faster. If you took the shortest route, you burned up the most fuel. If you aimed in one direction, you travelled in another... And that was merely allowing for gravitational fields. This time, the situation was much more complicated. No-one had ever before tried to steer a space-probe trailing forty thousand kilometres of wire. But the Ashoka programme had worked perfectly, all the way down to the edge of the atmosphere. In a few minutes the controller here on Sri Kanda would take over for the final descent. No wonder that Morgan looked tense.

"Van," said Maxine softly but firmly over the private circuit, "stop sucking your thumb. It makes you look like a baby."

Morgan registered indignation, then surprise - and finally relaxed with a slightly embarrassed laugh.

"Thanks for the warning," he said. "I'd hate to spoil my public image."

He looked with rueful amusement at the missing joint, wondering when the self-appointed wits would stop chortling: "Ha! The engineer hoist by his own petard!" After all the times he had cautioned others, he had grown careless and had managed to slash himself while demonstrating the properties of hyperfilament. There had been practically no pain, and surprisingly little inconvenience. One day he would do something about it; but he simply could not afford to spend a whole week hitched up to an organ regenerator, just for two centimetres of thumb.

"Altitude two five zero," said a calm, impersonal voice from the control hut. "Probe velocity one one six zero metres per second. Wire tension ninety percent nominal. Parachute deploys in two minutes."

After his momentary relaxation, Morgan was once again tense and alert - like a boxer, Maxine Duval could not help thinking, watching an unknown but dangerous opponent.

"What's the wind situation?" he snapped.

Another voice answered, this time far from impersonal.

"I can't believe this," it said in worried tones. "But Monsoon Control has just issued a gale warning."

"This is no time for jokes."

"They're not joking; I've just checked back."

"But they guaranteed no gusts above thirty kilometres an hour!"

"They've just raised that to sixty - correction, eighty. Something's gone badly wrong..."

"I'll say," Duval murmured to herself. Then she instructed her distant eyes and ears: "Fade into the woodwork - they won't want you around - but don't miss anything." Leaving her Rem to cope with these somewhat contradictory orders, she switched to her excellent information service. It took her less than thirty seconds to discover which meteorological station was responsible for the weather in the Taprobane area. And it was frustrating, but not surprising, to find that it was not accepting incoming calls from the general public.

Leaving her competent staff to break through that obstacle, she switched back to the mountain. And she was astonished to find how much, even in this short interval, conditions had worsened.

The sky had become darker; the microphones were picking up the faint, distant roar of the approaching gale. Maxine Duval had known such sudden changes of weather at sea, and more than once had taken advantage of them in her ocean racing. But this was unbelievably bad luck; she sympathised with Morgan, whose dreams and hopes might all be swept away by this unscheduled - this impossible - blast of air.

"Altitude two zero zero. Probe velocity one one five metres a second. Tension ninety-five percent nominal."

So the tension was increasing - in more ways than one. The experiment could not be called off at this late stage; Morgan would simply have to go ahead, and hope for the best. Duval wished that she could speak to him, but knew better than to interrupt him at this crisis.

"Altitude one nine zero. Velocity one one zero zero. Tension one hundred five percent. First parachute deployment - NOW!"

So - the probe was committed; it was a captive of the earth's atmosphere. Now the little fuel that remained must be used to steer it into the catching net spread out on the mountainside. The cables supporting that net were already thrumming as the wind tore through them.

Abruptly, Morgan emerged from the control hut, and stared up at the sky. Then he turned and looked directly at the camera.

"Whatever happens, Maxine," he said slowly and carefully, "the test is already ninety-five percent successful. No - ninety-nine percent. We've made it for thirty-six thousand kilometres, and have less than two hundred to go."

Duval made no reply. She knew that the words were not intended for her, but for the figure in the complicated wheelchair just outside the hut. The vehicle proclaimed the occupant; only a visitor to earth would have need of such a device. The doctors could now cure virtually all muscular defects - but the physicists could not cure gravity.

How many powers and interests were now concentrated upon this mountain top! The very forces of nature - the Bank of Narodny Mars - the Autonomous North

African Republic - Vannevar Morgan (no mean natural force himself) - and those gently implacable monks in their windswept eyrie.

Maxine Duval whispered instructions to her patient Rem, and the camera tilted smoothly upwards. There was the summit, crowned by the dazzling white walls of the temple. Here and there along its parapets Duval could catch glimpses of orange robes fluttering in the gale. As she had expected, the monks were watching.

She zoomed towards them, close enough to see individual faces. Though she had never met the Maha Thero (for an interview had been politely refused) she was confident that she could identify him. But there was no sign of the prelate; perhaps he was in the sanctum sanctorum, focusing his formidable will upon some spiritual exercise.

Maxine Duval was not sure if Morgan's chief antagonist indulged in anything so naïve as prayer. But if he had indeed prayed for this miraculous storm, his request was about to be answered. The Gods of the Mountain were awakening from their slumbers.

29. Final Approach

With increasing technology goes increasing vulnerability; the more Man conquers (sic) Nature the more liable he becomes to artificial catastrophes. Recent history provides sufficient proof of this - for example, the sinking of Marina City (2127), the collapse of the Tycho B dome (2098), the escape of the Arabian iceberg from its towlines (2062) and the melting of the Thor reactor (2009). We can be sure that the list will have even more impressive additions in the future. Perhaps the most terrifying prospects are those that involve psychological, not only technological, factors. In the past, a mad bomber or sniper could kill only a handful of people; today it would not be difficult for a deranged engineer to assassinate a city. The narrow escape of O'Neill Space Colony II from just such a disaster in 2047 has been well documented. Such incidents, in theory at least, could be avoided by careful screening and "fail-safe" procedures - though all too often these live up only to the first half of their name.

There is also a most interesting, but fortunately very rare, type of event where the individual concerned is in a position of such eminence, or has such unique powers, that no-one realises what he is doing until it is too late. The devastation created by such mad geniuses (there seems no other good term for them) can be worldwide, as in the case of A. Hitler (1889-1945). In a surprising number of instances nothing is heard of their activities, thanks to a conspiracy of silence among their embarrassed peers.

A classic example has recently come to light with the publication of Dame Maxine Duval's eagerly awaited, and much postponed, Memoirs. Even now, some aspects of the matter are still not entirely clear.

(Civilisation and its Malcontents: J. K. Golitsyn, Prague, 2175)

"Altitude one five zero, velocity ninety-five - repeat, ninety-five. Heat shield jettisoned."

So the probe had safely entered the atmosphere, and got rid of its excess speed. But it was far too soon to start cheering. Not only were there a hundred and fifty vertical kilometres still to go, but three hundred horizontal ones - with a howling gale to complicate matters. Though the probe still carried a small amount of propellent, its freedom to manoeuvre was very limited. If the operator missed the mountain on the first approach, he could not go round and try again.

"Altitude one two zero. No atmospheric effects yet."

The little probe was spinning itself down from the sky, like a spider descending its silken ladder. I hope, Duval thought to herself, that they have enough wire: how infuriating if they run out, only a few kilometres from the target! Just such tragedies had occurred with some of the first submarines cables, three hundred years ago.

"Altitude eight zero. Approach nominal. Tension one hundred percent. Some air drag."

So - the upper atmosphere was beginning to make itself felt, though as yet only to the sensitive instruments aboard the tiny vehicle.

A small, remotely controlled telescope had been set up beside the control truck, and was now automatically tracking the still invisible probe. Morgan walked towards it, and Duval's Rem followed him like a shadow.

"Anything in sight?" Duval whispered quietly, after a few seconds. Morgan shook his head impatiently, and kept on peering through the eyepiece.

"Altitude six zero. Moving off to the left - tension one hundred five percent - correction, one hundred ten."

Still well within limits, thought Duval - but things were starting to happen up there on the other side of the stratosphere. Surely, Morgan had the probe in sight now - "Altitude five five - giving two-second impulse correction." "Got it!" exclaimed Morgan. "I can see the jet!" "Altitude five zero. Tension one hundred five percent. Hard to keep on course - some buffeting."

It was inconceivable that, with a mere fifty kilometres to go, the little probe would not complete its thirty-six-thousand kilometre journey. But for that matter how many aircraft - and spacecraft - had come to grief in the last few metres?

"Altitude four five. Strong sheer wind. Going off course again. Three second impulse."

"Lost it," said Morgan in disgust. "Cloud in the way."

"Altitude four zero. Buffeting badly. Tension peaking at one fifty - I repeat, one fifty percent."

That was bad; Duval knew that the breaking strain was two hundred percent. One bad jerk, and the experiment would be over.

"Altitude three five. Wind getting worse. One second impulse. Propellent reserve almost gone. Tension still peaking - up to one seventy."

Another thirty percent, thought Duval, and even that incredible fibre would snap, like any other material when its tensile strength has been exceeded.

"Range three zero. Turbulence getting worse. Drifting badly to the left. Impossible to calculate correction - movements too erratic."

"I've got it!" Morgan cried. "It's through the clouds!"

"Range two five. Not enough propellent to get back on course. Estimate we'll miss by three kilometres."

"It doesn't matter!" shouted Morgan. "Crash where you can !" "Will do soonest. Range two zero. Wind forces increasing. Losing stabilisation. Payload starting to spin."

"Release the brake - let the wire run out!"

"Already done," said that maddeningly calm voice. Duval could have imagined that a machine was speaking, if she had not known that Morgan had borrowed a top space-station traffic controller for the job. "Dispenser malfunction. Payload spin now five revs second. Wire probably entangled. Tension one eight zero percent. One nine zero. Two zero zero. Range one five. Tension two one zero. Two two zero. Two three zero."

It can't last much longer, thought Duval. Only a dozen kilometres to go, and the damned wire had got tangled up in the spinning probe.

"Tension zero - repeat, zero."

That was it; the wire had snapped, and must be slowly snaking back towards the stars. Doubtless the operators on Ashoka would wind it in again, but Duval had now glimpsed enough of the theory to realise that this would be a long and complicated task. And the little payload would crash somewhere down there in the fields and jungles of Taprobane. Yet, as Morgan had said, it had been more than ninety-five percent successful. Next time, when there was no wind...

"There it is!" someone shouted.

A brilliant star had ignited, between two of the cloud-galleons sailing across the sky; it looked like a daylight meteor, falling down to earth. Ironically, as if mocking its builders, the flare installed on the probe to assist terminal guidance had automatically triggered. Well, it could still serve some useful purpose. It would help to locate the wreckage.

Duval's Rem slowly pivoted so that she could watch the blazing day-star sail past the mountain and disappear into the east; she estimated that it would land less than five kilometres away. Then she said, "Take me back to Dr. Morgan. I'd like a word with him."

She had intended to make a few cheerful remarks - loud enough for the Martian banker to hear - expressing her confidence that, next time, the lowering

would be a complete success. Duval was still composing her little speech of reassurance when it was swept out of her mind. She was to play back the events of the next thirty seconds until she knew them by heart. But she was never quite sure if she fully understood them.

30. The Legions of the King

Vannevar Morgan was used to setbacks - even disasters - and this was, he hoped, a minor one. His real worry, as he watched the flare vanish over the shoulder of the mountain, was that Narodny Mars would consider its money wasted. The hard-eyed observer in his elaborate wheel-chair had been extremely uncommunicative; Earth's gravity seemed to have immobilised his tongue as effectively as his limbs. But this time he addressed Morgan before the engineer could speak to him.

"Just one question, Dr. Morgan. I know that this gale is unprecedented - yet it happened. So it may happen again. What if it does - when the Tower is built?"

Morgan thought quickly. It was impossible to give an accurate answer, at such short notice, and he could still scarcely believe what had happened.

"At the very worst, we might have to suspend operations briefly: there could be some track distortion. No wind forces that ever occur at this altitude could endanger the Tower structure itself. Even this experimental fibre would have been perfectly safe - if we'd succeeded in anchoring it."

He hoped that this was a fair analysis; in a few minutes, Warren Kingsley would let him know whether it was true or not. To his relief, the Martian answered, with apparent satisfaction: "Thank you; that was all I wanted to know."

Morgan, however, was determined to drive the lesson home.

"And on Mount Pavonis, of course, such a problem couldn't possibly arise. The atmospheric density there is less than a hundredth -"

Not for decades had he heard the sound that now crashed upon his ears, but it was one that no man could ever forget. Its imperious summons, overpowering the roar of the gale, transported Morgan halfway round the world. He was no longer standing on a windswept mountainside; he was beneath the dome of the Hagia Sophia, looking up in awe and admiration at the work of men who had died sixteen centuries ago. And in his ears sounded the tolling of the mighty bell that had once summoned the faithful to prayer.

The memory of Istanbul faded; he was back on the mountain, more puzzled and confused than ever.

What was it that the monk had told him - that Kalidasa's unwelcome gift had been silent for centuries, and was allowed to speak only in time of disaster? There had been no disaster here; indeed, as far as the monastery was concerned, precisely the opposite. Just for a moment, the embarrassing possibility occurred to Morgan that the probe might have crashed into the temple precincts. No, that was out of the question; it had missed the peak with kilometres to spare. And in

any event it was much too small an object to do any serious damage as it half-fell, half-glided out of the sky.

He stared up at the monastery, from which the voice of the great bell still challenged the gale. The orange robes had all vanished from the parapets; there was not a monk in sight.

Something brushed delicately against Morgan's cheek, and he automatically flicked it aside. It was hard even to think while that dolorous throbbing filled the air and hammered at his brain. He supposed he had better walk up to the temple, and politely ask the Maha Thero what had happened.

Once more that soft, silken contact against his face, and this time he caught a glimpse of yellow out of the corner of his eye. His reactions had always been swift; he grabbed, and did not miss.

The insect lay crumpled in the palm of his hand, yielding up the last seconds of its ephemeral life even as Morgan watched - and the universe he had always known seemed to tremble and dissolve around him. His miraculous defeat had been converted into an even more inexplicable victory, yet he felt no sense of triumph - only confusion and astonishment.

For he remembered, now, the legend of the golden butterflies. Driven by the gale, in their hundreds and thousands, they were being swept up the face of the mountain, to die upon its summit. Kalidasa's legions had at last achieved their goal - and their revenge.

31. Exodus

"What happened?" said Sheik Abdullah.

That's a question I'll never be able to answer, Morgan told himself. But he replied: "The Mountain is ours, Mr. President; the monks have already started to leave. It's incredible - how could a two-thousand-year-old legend...? " He shook his head in baffled wonder.

"If enough men believe in a legend, it becomes true."

"I suppose so. But there's much more to it than that - the whole chain of events still seems impossible."

"That's always a risky word to use. Let me tell you a little story. A dear friend, a great scientist, now dead, used to tease me by saying that because politics is the art of the possible, it appeals only to second-rate minds. For the first-raters, he claimed, are only interested in the impossible. And do you know what I answered?"

"No," said Morgan, politely and predictably.

"It's lucky there are so many of us - because someone has to run the world... Anyway, if the impossible has happened, you should accept it thankfully."

I accept it, thought Morgan - reluctantly. There is something very strange about a universe where a few dead butterflies can balance a billion-ton tower.

And there was the ironic role of the Venerable Parakarma, who must surely now feel that he was the pawn of some malicious gods. The Monsoon Control Administrator had been most contrite, and Morgan had accepted his apologies with unusual graciousness. He could well believe that the brilliant Dr. Choam Goldberg had revolutionised micrometeorology, that no-one had really understood all that he was doing, and that he had finally had some kind of a nervous breakdown while conducting his experiments. It would never happen again. Morgan had expressed his - quite sincere - hopes for the scientist's recovery, and had retained enough of his bureaucrat's instincts to hint that, in due course, he might expect future considerations from Monsoon Control. The Administrator had signed off with grateful thanks, doubtless wondering at Morgan's surprising magnanimity.

"As a matter of interest," asked the Sheik, "where are the monks going? I might offer them hospitality here. Our culture has always welcomed other faiths."

"I don't know; nor does Ambassador Rajasinghe. But when I asked him he said: They'll be all right. An order that's lived frugally for three thousand years is not exactly destitute."

"Hmm. Perhaps we could use some of their wealth. This little project of yours gets more expensive each time you see me."

"Not really, Mr. President. That last estimate includes a purely book-keeping figure for deep-space operations, which Narodny Mars has now agreed to finance. They will locate a carbonaceous asteroid and navigate it to earth orbit - they've much more experience at this sort of work, and it solves one of our main problems."

"What about the carbon for their own tower?"

"They have unlimited amounts on Deimos - exactly where they need it. Narodny has already started a survey for suitable mining sites, though the actual processing will have to be off-moon."

"Dare I ask why?"

"Because of gravity. Even Deimos has a few centimetres per second squared. Hyperifilament can only be manufactured in completely zero gee conditions. There's no other way of guaranteeing a perfect crystalline structure with sufficient long-range organisation."

"Thank you, Van. Is it safe for me to ask why you've changed the basic design? I liked that original bundle of four tubes, two up and two down. A straightforward subway system was something I could understand-even if it was up-ended ninety degrees."

Not for the first time, and doubtless not for the last, Morgan was amazed by the old man's memory and his grasp of details. It was never safe to take anything for granted with him; though his questions were sometimes inspired by pure curiosity - often the mischievous curiosity of a man so secure that he had no need to uphold his dignity - he never overlooked anything of the slightest importance.

"I'm afraid our first thoughts were too earth-orientated. We were rather like the early motor-car designers, who kept producing horseless carriages. So now our design is a hollow square tower with a track up each face. Think of it as four vertical railroads. Where it starts from orbit, it's forty metres on a side, and it tapers down to twenty when it reaches Earth."

"Like a stalag - stalac -"

"Stalactite. Yes, I had to look it up! From the engineering point of view, a good analogy now would be the old Eiffel Tower - turned upside down and stretched out a hundred thousand times."

"As much as that?"

"Just about."

"Well, I suppose there's no law that says a tower can't hang downwards."

"We have one going upwards as well, remember - from the synchronous orbit out of the mass anchor that keeps the whole structure under tension."

"And Midway Station? I hope you haven't changed that."

"Yes, it's still at the same place - twenty-five thousand kilometres."

"Good. I know I'll never get there, but I like to think about it... " He muttered something in Arabic. "There's another legend, you know - Mahomet's coffin, suspended between heaven and earth. Just like Midway."

"We'll arrange a banquet for you there, Mr. President, when we inaugurate the service."

"Even if you keep to your schedule - and I admit you only slipped a year on the Bridge - I'll be ninety-eight then. No, I doubt if I'll make it."

But I shall, said Vannevar Morgan to himself. For now I know that the gods are on my side; whatever gods may be.

IV - THE TOWER

32. Space Express

"Now don't you say," begged Warren Kingsley, "it'll never get off the ground."

"I was tempted," chuckled Morgan, as he examined the full-scale mock-up. "It does look rather like an upended railroad coach."

"That's exactly the image we want to sell," Kingsley answered. "You buy your ticket at the station, check in your baggage, settle down in your swivel seat,

and admire the view. Or you can go up to the lounge-cum-bar and devote the next five hours to serious drinking, until they carry you off at Midway. Incidentally, what do you think of the Design Section's idea - nineteenth-century Pullman decor?"

"Not much. Pullman cars didn't have five circular floors, one on top of the other."

"Better tell Design that - they've set their hearts on gas-lighting."

"If they want an antique flavour that's a little more appropriate, I once saw an old space movie at the Sydney Art Museum. There was a shuttle craft of some kind that had a circular observation lounge - just what we need."

"Do you remember its name?"

"Oh - let's think - something like Space Wars 2000. I'm sure you'll be able to trace it."

"I'll tell Design to look it up. Now let's go inside - do you want a hard-hat?"

"No," answered Morgan brusquely. That was one of the few advantages of being ten centimetres shorter than average height.

As they stepped into the mock-up, he felt an almost boyish thrill of anticipation. He had checked the designs, watched the computers playing with the graphics and layout - everything here would be perfectly familiar. But this was real - solid. True, it would never leave the ground, just as the old joke said. But one day its identical brethren would be hurtling up through the clouds and climbing, in only five hours, to Midway Station, twenty-five thousand kilometres from Earth. And all for about one dollar's worth of electricity per passenger.

THE FOUNTAINS OF PARADISE

Even now, it was impossible to realise the full meaning of the coming revolution. For the first time Space itself would become as accessible as any point on the surface of the familiar Earth. In a few more decades, if the average man wanted to spend a weekend on the moon, he could afford to do so. Even Mars would not be out of the question; there were no limitations to what might now be possible.

Morgan came back to earth with a bump, as he almost tripped over a piece of badly-laid carpet.

"Sorry," said his guide, "another of Design's ideas - that green is supposed to remind people of Earth. The ceilings are going to be blue, getting deeper and deeper on the upper floors. And they want to use indirect lighting everywhere, so that the stars will be visible."

Morgan shook his head. "That's a nice idea, but it won't work. If the lighting's good enough for comfortable reading, the glare will wipe out the stars. You'll need a section of the lounge that can be completely blacked-out."

"That's already planned for part of the bar - you can order your drink, and retire behind the curtains."

They were now standing in the lowest floor of the capsule, a circular room eight metres in diameter, three metres high. All around were miscellaneous boxes, cylinders and control panels bearing such labels as OXYGEN RESERVE, BATTERY, CO, CRACKER, MEDICAL, TEMPERATURE CONTROL. Everything was clearly of a provisional, temporary nature, liable to be rearranged at a moment's notice.

"Anyone would think we were building a spaceship," Morgan commented. "Incidentally, what's the latest estimate of survival time?"

"As long as power's available, at least a week, even for a full load of fifty passengers. Which is really absurd, since a rescue team could always reach them in three hours, either from Earth or Midway."

"Barring a major catastrophe, like damage to the tower or tracks."

"If that ever happens, I don't think there will be anyone to rescue. But if a capsule gets stuck for some reason, and the passengers don't go mad and gobble up all our delicious emergency compressed food tablets at once, their biggest problem will be boredom."

The second floor was completely empty, devoid even of temporary fittings. Someone had chalked a large rectangle on the curved plastic panel of the wall and printed inside it: AIRLOCK HERE?

"This will be the baggage room - though we're not sure if we'll need so much space. If not, it can be used for extra passengers. Now, this floor's much more interesting -"

The third level contained a dozen aircraft-type chairs, all of different designs; two of them were occupied by realistic dummies, male and female, who looked very bored with the whole proceedings.

"We've practically decided on this model," said Kingsley, pointing to a luxurious tilting swivel-chair with attached small table, "but we'll run the usual survey first."

Morgan punched his fist into the seat cushion.

"Has anyone actually sat in it for five hours?" he asked.

"Yes - a hundred-kilo volunteer. No bed-sores. If people complain, we'll remind them of the pioneering days of aviation, when it took five hours merely to cross the Pacific. And, of course, we're offering low-gee comfort almost all the way."

The floor above was identical in concept, though empty of chairs. They passed through it quickly and reached the next level, to which the designers had obviously devoted most attention.

The bar looked almost functional, and indeed the coffee dispenser was actually working. Above it, in an elaborately gilded frame, was an old engraving of such uncanny relevance that it took Morgan's breath away. A huge full moon dominated the upper left quadrant, and racing towards it was - a bullet-shaped

train towing four carriages. From the windows of the compartment labelled "First Class" top-hatted Victorian personages could be seen admiring the view.

"Where did you get hold of that?" Morgan asked in astonished admiration.

"Looks as if the caption's fallen off again," Kingsley apologised, hunting round behind the bar. "Ah, here it is."

He handed Morgan a piece of card upon which was printed, in old-fashioned typeface,

PROJECTILE TRAINS FOR THE MOON

Engraving from 1881 Edition of

FROM THE EARTH TO THE MOON

Direct

In 97 Hours and 20 Minutes

AND A TRIP AROUND FF

By Jules Verne

"I'm sorry to say I've never read it," said Morgan, when he had absorbed this information. "It might have saved me a lot of trouble. But I'd like to know how he managed without any rails...''

"We shouldn't give Jules too much credit - or blame. This picture was never meant to be taken seriously - it was a joke of the artist."

"Well - give Design my compliments; it's one of their better ideas."

Turning away from the dreams of the past, Morgan and Kingsley walked towards the reality of the future. Through the wide observation window a back-projection system gave a stunning view of Earth - and not just any view, Morgan was pleased to note, but the correct one. Taprobane itself was hidden, of course, being directly below; but there was the whole subcontinent of Hindustan, right out to the dazzling snows of the Himalayas.

"You know," Morgan said suddenly, "it will be exactly like the Bridge, all over again. People will take the trip just for the view. Midway Station could be the biggest tourist attraction ever." He glanced up at the azure-blue ceiling. "Anything worth looking at on the last floor?"

"Not really - the upper air-lock is finalised, but we haven't decided where to put the life-support backup gear and the electronics for the track-centring controls."

"Any problems there?"

"Not with the new magnets. Powered or coasting, we can guarantee safe clearance up to eight thousand kilometres an hour - fifty percent above maximum design speed."

Morgan permitted himself a mental sigh of relief. This was one area in which he was quite unable to make any judgements, and had to rely completely on the advice of others. From the beginning, it had been obvious that only some form of magnetic propulsion could operate at such speeds; the slightest physical contact - at more than a kilometre a second! - would result in disaster. And yet the four pairs of guidance slots running up the faces of the tower had only centimetres of clearance around the magnets; they had to be designed so that enormous restoring forces came instantly into play, correcting any movement of the capsule away from the centre line.

As Morgan followed Kingsley down the spiral stairway which extended the full height of the mockup, he was suddenly struck by a sombre thought. I'm getting old, he said to himself. Oh, I could have climbed to the sixth level without any trouble; but I'm glad we decided not to.

Yet I'm only fifty-nine - and it will be at least five years, even if all goes very well, before the first passenger car rides up to Midway Station. Then another three years of tests, calibration, system tune-ups. Make it ten years, to be on the safe side...

Though it was warm, he felt a sudden chill. For the first time, it occurred to Vannevar Morgan that the triumph upon which he had set his soul might come too late for him. And quite unconsciously he pressed his hand against the slim metal disc concealed inside his shirt.

33. CORA

"Why did you leave it until now?" Dr. Sen had asked, in a tone appropriate to a retarded child.

"The usual reason," Morgan answered, as he ran his good thumb along the seal of his shirt. "I was too busy - and whenever I felt short of breath I blamed it on the height."

"Altitude was partly to blame, of course. You'd better check all your people on the mountain. How could you have overlooked anything so obvious?"

How indeed? thought Morgan, with some embarrassment.

"All those monks - some of them were over eighty! They seemed so healthy that it never occurred to me..."

"The monks have lived up there for years - they're completely adapted. But you've been hopping up and down several times a day -"

"- twice, at the most -"

"- going from sea level to half an atmosphere in a few minutes. Well, there's no great harm done - if you follow instructions from now on. Mine, and CORA's."

"CORA's?"

"Coronary alarm."

"Oh - one of those things."

"Yes - one of those things. They save about ten million lives a year. Mostly top civil servants, senior administrators, distinguished scientists, leading engineers and similar nit-wits. I often wonder if it's worth the trouble. Nature may be trying to tell us something, and we're not listening."

"Remember your Hippocratic Oath, Bill," retorted Morgan with a grin. "And you must admit that I've always done just what you told me. Why, my weight hasn't changed a kilo in the last ten years."

"Urn... Well, you're not the worst of my patients," said the slightly mollified doctor. He fumbled round in his desk and produced a large holopad. "Take your choice-here are the standard models. Any colour you like as long as it's Medic Red."

Morgan triggered the images, and regarded them with distaste.

"Where do I have to carry the thing?" he asked. "Or do you want to implant it?"

"That isn't necessary, at least for the present. In five years' time, maybe, but perhaps not even then. I suggest you start with this model - it's worn just under the breastbone, so doesn't need remote sensors. After a while you won't notice it's there. And it won't bother you, unless it's needed."

"And then?"

"Listen."

The doctor threw one of the numerous switches on his desk console, and a sweet mezzo-soprano voice remarked in a conversational tone: "I think you should sit down and rest for about ten minutes." After a brief pause it continued: "It would be a good idea to lie down for half an hour." Another pause: "As soon as convenient, make an appointment with Dr. Sen." Then:

"Please take one of the red pills immediately."

"I have called the ambulance; just lie down and relax. Everything will be all right."

Morgan almost clapped his hands over his ears to cut out the piercing whistle.

"THIS IS A CORA ALERT. WILL ANYONE WITHIN RANGE OF MY VOICE PLEASE COME IMMEDIATELY. THIS IS A CORA ALERT. WILL -"

"I think you get the general idea," said the doctor, restoring silence to his office. "Of course, the programmes and responses are individually tailored to the subject. And there's a wide range of voices, including some famous ones."

"That will do very nicely. When will my unit be ready?"

"I'll call you in about three days. Oh yes - there's an advantage to the chest-worn units I should mention."

"What's that?"

"One of my patients is a keen tennis player. He tells me that when he opens his shirt the sight of that little red box has an absolutely devastating effect on his opponent's game..."

34. Vertigo

There had once been a time when a minor, and often major, chore of every civilised man had been the regular updating of his address book. The universal code had made that unnecessary, since once a person's lifetime identity number was known he could be located within seconds. And even if his number was not known, the standard search programme could usually find it fairly quickly, given the approximate date of birth, his profession, and a few other details. (There were, of course, problems if the name was Smith, or Singh, or Mohammed...)

The development of global information systems had also rendered obsolete another annoying task. It was only necessary to make a special notation against the names of those friends one wished to greet on their birthdays or other anniversaries, and the household computer would do the rest. On the appropriate day (unless, as was frequently the case, there had been some stupid mistake in programming) the right message would be automatically flashed to its destination. And even though the recipient might shrewdly suspect that the warm words on his screen were entirely due to electronics - the nominal sender not having thought of him for years - the gesture was nevertheless welcome.

But the same technology that had eliminated one set of tasks had created even more demanding successors. Of these, perhaps the most important was the design of the Personal Interest Profile.

Most men updated their PIP on New Year's Day, or their birthday. Morgan's list contained fifty items; he had heard of people with hundreds. They must spend all their waking hours battling with the flood of information, unless they were like those notorious pranksters who enjoyed setting up News Alerts on their consoles for such classic improbabilities as:

Eggs, Dinosaur, hatching of

Circle, squaring of

Atlantis, re-emergence of

Christ, Second Coming of

Loch Ness Monster, capture of

or finally

World, end of

Usually, of course, egotism and professional requirements ensured that the subscriber's own name was the first item on every list. Morgan was no exception, but the entries that followed were slightly unusual:

Tower, orbital

Tower, space

Tower, (geo) synchronous

Elevator, space

Elevator, orbital

Elevator, (geo) synchronous

These names covered most of the variations used by the media, and ensured that he saw at least ninety percent of the news items concerning the project. The vast majority of these were trivial, and sometimes he wondered if it was worth searching for them - the ones that really mattered would reach him quickly enough.

He was still rubbing his eyes, and the bed had scarcely retracted itself into the wall of his modest apartment, when Morgan noticed that the Alert was flashing on his console. Punching the COFFEE and READOUT buttons simultaneously, he awaited the latest overnight sensation.

ORBITAL TOWER SHOT DOWN

said the headline.

"Follow up?" asked the console.

"You bet," replied Morgan, now instantly awake.

During the next few seconds, as he read the text display, his mood changed from incredulity to indignation, and then to concern. He switched the whole news package to Warren Kingsley with a "Please call me back as soon as possible" tag, and settled down to breakfast, still fuming.

Less than five minutes later, Kingsley appeared on the screen.

"Well, Van," he said with humorous resignation, "we should consider ourselves lucky. It's taken him five years to get round to us.''

"It's the most ridiculous thing I ever heard of! Should we ignore it? If we answer, that will only give him publicity. Which is just what he wants."

Kingsley nodded. "That would be the best policy - for the present. We shouldn't over-react. At the same time, he may have a point."

"What do you mean?"

Kingsley had become suddenly serious, and even looked a little uncomfortable.

"There are psychological problems as well as engineering ones," he said. "Think it over. I'll see you at the office."

The image faded from the screen, leaving Morgan in a somewhat subdued frame of mind. He was used to criticism, and knew how to handle it; indeed, he thoroughly enjoyed the give-and-take of technical arguments with his peers, and was seldom upset on those rare occasions when he lost. It was not so easy to cope with Donald Duck.

That, of course, was not his real name, but Dr. Donald Bickerstaff's peculiar brand of indignant negativism often recalled that mythological twentieth-century character. His degree (adequate, but not brilliant) was in pure mathematics; his assets were an impressive appearance, a mellifluous voice, and an unshakeable belief in his ability to deliver judgements on any scientific subject. In his own field, indeed, he was quite good; Morgan remembered with pleasure an old-style public lecture of the doctor's which he had once attended at the Royal Institution. For almost a week afterwards he had almost understood the peculiar properties of transfinite numbers.

Unfortunately, Bickerstaff did not know his limitations. Though he had a devoted coterie of fans who subscribed to his information service - in an earlier age, he would have been called a pop-scientist - he had an even larger circle of critics. The kinder ones considered that he had been educated beyond his intelligence. The others labelled him a self-employed idiot. It was a pity, thought Morgan, that Bickerstaff couldn't be locked in a room with Dr. Goldberg/Parakarma; they might annihilate each other like electron and positron - the genius of one cancelling out the fundamental stupidity of the other. That unshakeable stupidity against which, as Goethe lamented, the Gods themselves contend in vain. No gods being currently available, Morgan knew that he would have to undertake the task himself. Though he had much better things to do with his time, it might provide some comic relief; and he had an inspiring precedent.

There were few pictures in the hotel room that had been one of Morgan's four "temporary" homes for almost a decade. Most prominent of them was a photograph so well faked that some visitors could not believe that its components were all perfectly genuine. It was dominated by the graceful, beautifully restored steamship - ancestor of every vessel that could thereafter call itself modern. By her side, standing on the dock to which she had been miraculously returned a century and a quarter after her launch, was Dr. Vannevar Morgan. He was looking up at the scrollwork of the painted prow; and a few metres away, looking quizzically at him, was Isambard Kingdom Brunel - hands thrust in pockets, cigar clenched firmly in his mouth, and wearing a very rumpled, mud-spattered suit.

Everything in the photo was quite real; Morgan had indeed been standing beside the Great Britain, on a sunny day in Bristol the year after the Gibraltar Bridge was completed. But Brunel was back in 1857, still awaiting the launch of his later and more famous leviathan, whose misfortunes were to break his body and spirit.

The photograph had been presented to Morgan on his fiftieth birthday, and it was one of his most cherished possessions. His colleagues had intended it as a sympathetic joke, Morgan's admiration for the greatest engineer of the nineteenth century being well known. There were times, however, when he wondered if their choice was more appropriate than they realised. The Great Eastern had devoured her creator. The Tower might yet do the same to him.

Brunel, of course, had been surrounded by Donald Ducks. The most persistent was one Doctor Dionysius Lardner, who had proved beyond all doubt that no steamship could ever cross the Atlantic. An engineer could refute criticisms which were based on errors of fact or simple miscalculations. But the point that Donald Duck had raised was more subtle and not so easy to answer. Morgan suddenly recalled that his hero had to face something very similar, three centuries ago.

He reached for his small but priceless collection of genuine books, and pulled out the one he had read, perhaps, more often than any other - Rolt's classic biography Isambard Kingdom Brunel. Leafing through the well-thumbed pages, he quickly found the item that had stirred his memory.

Brunel had planned a railway tunnel almost three kilometres long - a "monstrous and extraordinary, most dangerous and impracticable" concept. It was inconceivable, said the critics, that human beings could tolerate the ordeal of hurtling through its Stygian depths. "No person would desire to be shut out from daylight with a consciousness that he had a superincumbent weight of earth sufficient to crush him in case of accident... the noise of two trains passing would shake the nerves... no passenger would be induced to go twice..."

It was all so familiar. The motto of the Lardners and the Bickerstaffs seemed to be: "Nothing shall be done for the first time."

And yet - sometimes they were right, if only through the operation of the laws of chance. Donald Duck made it sound so reasonable. He had begun by saying, in a display of modesty as unusual as it was spurious, that he would not presume to criticise the engineering aspects of the space elevator. He only wanted to talk about the psychological problems it would pose. They could be summed up in one word: Vertigo. The normal human being, he had pointed out, had a well-justified fear of high places; only acrobats and tightrope artistes were immune to this natural reaction. The tallest structure on earth was less than five

kilometres high - and there were not many people who would care to be hauled vertically up the piers of the Gibraltar Bridge.

Yet that was nothing compared to the appalling prospect of the orbital tower. "Who has not stood," Bickerstaff declaimed, "at the foot of some immense building, staring up at its sheer precipitous face, until it seemed about to topple and fall? Now imagine such a building soaring on and on through the clouds, up into the blackness of space, through the ionosphere, past the orbits of all the great space-stations - up and up until it reaches a large fraction of the way to the moon! An engineering triumph, no doubt - but a psychological nightmare. I suggest that some people will go mad at its mere contemplation. And how many could face the vertiginous ordeal of the ride - straight upwards, hanging over empty space, for twenty-five thousand kilometres to the first stop at the Midway Station?

"It is no answer to say that perfectly ordinary individuals can fly in spacecraft to the same altitude, and far beyond. The situation then is completely different - as indeed it is in ordinary atmospheric flight. The normal man does not feel vertigo even in the open gondola of a balloon, floating through the air a few kilometres above the ground. But put him on the edge of a cliff at the same altitude, and study his reactions then!

"The reason for this difference is quite simple. In an aircraft, there is no physical connexion linking the observer and the ground. Psychologically, therefore, he is completely detached from the hard, solid earth far below. Falling no longer has terrors for him; he can look down upon remote and tiny landscapes which he would never dare to contemplate from any high elevation. That saving physical detachment is precisely what the space elevator will lack. The hapless passenger, whisked up the sheer face of the gigantic tower, will be all too conscious of his link with earth. What guarantee can there possibly be that anyone not drugged or anaesthetised could survive such an experience? I challenge Dr. Morgan to answer."

Dr. Morgan was still thinking of answers, few of them polite, when the screen lit up again with an incoming call. When he pressed the ACCEPT button, he was not in the least surprised to see Maxine Duval.

"Well, Van," she said, without any preamble, "what are you going to do?"

"I'm sorely tempted, but I don't think I should argue with that idiot. Incidentally, do you suppose that some aerospace organisation has put him up to it?"

"My men are already digging; I'll let you know if they find anything. Personally, I feel it's all his own work - I recognise the hallmarks of the genuine article. But you haven't answered my question."

"I haven't decided; I'm still trying to digest my breakfast. What do you think I should do?"

"Simple. Arrange a demonstration. When can you fix it?"

"In five years, if all goes well."

"That's ridiculous. You've got your first cable in position..." "Not cable - tape."

"Don't quibble. What load can it carry?"

"Oh - at the Earth end, a mere five hundred tons."

"There you are. Offer Donald Duck a ride."

"I wouldn't guarantee his safety."

"Would you guarantee mine?"

"You're not serious !"

"I'm always serious, at this hour of the morning. It's time I did another story on the Tower anyway. That capsule mock-up is very pretty, but it doesn't do anything. My viewers like action, and so do I. The last time we met, you showed me drawings of those little cars the engineers will use to run up and down the cable - I mean tapes. What did you call them?"

"Spiders."

"Ugh - that's right. I was fascinated by the idea. Here's something that has never been possible before, by any technology. For the first time you could sit still in the sky, even above the atmosphere, and watch the earth beneath - something that no spacecraft can ever do. I'd like to be the first to describe the sensation. And clip Donald Duck's wings at the same time."

Morgan waited for a full five seconds, staring Maxine straight in the eyes, before he decided that she was perfectly serious.

"I can understand," he said rather wearily, "just how a poor struggling young media-girl, trying desperately to make a name for herself, would jump at such an opportunity. I don't want to blight a promising career, but the answer is definitely no."

The doyen of media-persons emitted several unladylike, and even ungentlemanly, words, not commonly transmitted over public circuits.

"Before I strangle you in your own hyperfilament, Van," she continued, "why not?"

"Well, if anything went wrong, I'd never forgive myself."

"Spare the crocodile tears. Of course, my untimely demise would be a major tragedy - for your project. But I wouldn't dream of going until you'd made all the tests necessary, and were sure it was one hundred percent safe."

"It would look too much like a stunt."

"As the Victorians (or was it the Elizabethans?) used to say - so what?"

"Look, Maxine - there's a flash that New Zealand has just sunk - they'll need you in the studio. But thanks for the generous offer."

"Dr. Vannevar Morgan - I know exactly why you're turning me down. You want to be the first."

"As the Victorians used to say - so what?"

"Touché. But I'm warning you, Van - just as soon as you have one of those spiders working, you'll be hearing from me again."

Morgan shook his head. "Sorry, Maxine," he answered. "Not a chance -"

35. Starglider Plus Eighty

Extract from God and Starholme. (Mandala Press, Moscow, 2149)

Exactly eighty years ago, the robot interstellar probe now known as Starglider entered the Solar System, and conducted its brief but historic dialogue with the human race. For the first time, we knew what we had always suspected; that ours was not the only intelligence in the universe, and that out among the stars were far older, and perhaps far wiser, civilisations.

After that encounter, nothing would ever be the same again. And yet, paradoxically, in many ways very little has changed. Mankind still goes about its business, much as it has always done. How often do we stop to think that the Starholmers, back on their own planet, have already known of our existence for twenty-eight years - or that, almost certainly, we shall be receiving their first direct messages only twenty-four years from now? And what if, as some have suggested, they themselves are already on the way?

Men have an extraordinary, and perhaps fortunate, ability to tune out of their consciousness the most awesome future possibilities. The Roman farmer, ploughing the slopes of Vesuvius, gave no thought to the mountain smoking overhead. Half the twentieth century lived with the Hydrogen Bomb - half the twenty-first with the Golgotha virus. We have learned to live with the threat - or the promise - of Starholme.

Starglider showed us many strange worlds and races, but it revealed almost no advanced technology, and so had minimal impact upon the technically-orientated aspects of our culture. Was this accidental, or the result of some deliberate policy? There are many questions one would like to ask Starglider, now that it is too late - or too early.

On the other hand, it did discuss many matters of philosophy and religion, and in these fields its influence was profound. Although the phrase nowhere occurs in the transcripts, Starglider is generally credited with the famous aphorism "Belief in God is apparently a psychological artefact of mammalian reproduction".

But what if this is true? It is totally irrelevant to the question of God's actual existence, as I shall now proceed to demonstrate...

Swami Krisnamurthi (Dr. Choam Goldberg)

36. The Cruel Sky

The eye could follow the tape much further by night than by day. At sunset, when the warning lights were switched on, it became a thin band of incandescence, slowly dwindling away until, at some indefinite point, it was lost against the background of stars.

Already, it was the greatest wonder of the world. Until Morgan put his foot down and restricted the site to essential engineering staff, there was a continual flood of visitors - "pigrims", someone had ironically called them - paying homage to the sacred mountain's last miracle.

They would all behave in exactly the same way. First they would reach out and gently touch the five-centimetre-wide band, running their finger tips along it with something approaching reverence. Then they would listen, ears pressed against the smooth, cold material of the ribbon, as if they hoped to catch the music of the spheres. There were some, indeed, who claimed to have heard a deep, bass note at the uttermost threshold of audibility, but they were deluding themselves. Even the highest harmonics of the tape's natural frequency were far below the range of human hearing. And some would go away shaking their heads, saying:

"You'll never get me to ride up that thing!" But they were the ones who had made just the same remark about the fusion rocket, the space shuttle, the airplane, the automobile - even the steam locomotive...

To these sceptics, the usual answer was: "Don't worry - this is merely part of the scaffolding - one of the four tapes that will guide the Tower down to Earth. Riding up the final structure will be exactly like taking an elevator in any high building. Except that the trip will be longer - and much more comfortable."

Maxine Duval's trip, on the other hand, would be very short, and not particularly comfortable. But once Morgan had capitulated, he had done his best to make sure that it would be uneventful.

The flimsy "Spider" - a prototype test vehicle looking like a motorised Bosun's Chair - had already made a dozen ascents to twenty kilometres, with twice the load it would be carrying now. There had been the usual minor teething problems, but nothing serious; the last five runs had been completely trouble-free. And what could go wrong? If there was a power failure - almost unthinkable, in such a simple battery-operated system - gravity would bring Maxine safely home, the automatic brakes limiting the speed of descent. The only real risk was that the drive mechanism might jam, trapping Spider and its passenger in the upper atmosphere. And Morgan had an answer even for this.

"Only fifteen kilometres?" Maxine had protested. "A glider can do better than that!"

"But you can't, with nothing more than an oxygen mask. Of course, if you like to wait a year until we have the operational unit with its life-support system..."

"What's wrong with a space-suit?"

Morgan had refused to budge, for his own good reasons. Though he hoped it would not be needed, a small jet-crane was standing by at the foot of Sri Kanda. Its highly skilled operators were used to odd assignments; they would have no difficulty in rescuing a stranded Maxine, even at twenty kilometres altitude.

But there was no vehicle in existence that could reach her at twice that height. Above forty kilometres was no-man's land - too low for rockets, too high for balloons.

In theory, of course, a rocket could hover beside the tape, for a very few minutes, before it burned up all its propellent. The problems of navigation and actual contact with the Spider were so horrendous that Morgan had not even bothered to think about them. It could never happen in real life, and he hoped that no producer of video-drama would decide that there was good material here for a cliff-hanger. That was the sort of publicity he could do without.

Maxine Duval looked rather like a typical Antarctic tourist as, glittering in her metal-foil thermosuit, she walked towards the waiting Spider and the group of technicians round it. She had chosen the time carefully; the sun had risen only an hour ago, and its slanting rays would show the Taprobanean landscape to best advantage. Her Remote, even younger and huskier than on the last memorable occasion, recorded the sequence of events for her System-wide audience.

She had, as always, been thoroughly rehearsed. There was no fumbling or hesitation as she strapped herself in, pressed the BATTERY CHARGE button, took a deep draught of oxygen from her facemask, and checked the monitors on all her video and sound channels. Then, like a fighter pilot in some old historical movie, she signalled "Thumbs Up", and gently eased the speed control forward.

There was a small burst of ironic clapping from the assembled engineers, most of whom had already taken joy-rides up to heights of a few kilometres. Someone shouted: "Ignition! We have lift off!" and, moving about as swiftly as a brass bird-cage elevator in the reign of Victoria I, Spider began its stately ascent.

This must be like ballooning, Maxine told herself. Smooth, effortless, silent. No - not completely silent; she could hear the gentle whirr of the motors powering the multiple drive wheels that gripped the flat face of the tape. There was none of the sway or vibration that she had half expected; despite its slimness, the incredible band she was climbing was as rigid as a bar of steel, and the vehicle's gyros were holding it rock-steady. If she closed her eyes, she could easily imagine that she was already ascending the final tower. But, of course, she would not close her eyes; there was so much to see and absorb. There was even a good deal to hear; it was amazing how well sound carried, for the conversations below were still quite audible.

She waved to Vannevar Morgan, then looked for Warren Kingsley. To her surprise she was unable to find him; though he had helped her aboard Spider, he had now vanished. Then she remembered his frank admission - sometimes he made it sound almost like a wry boast - that the best structural engineer in the world couldn't stand heights... Everyone had some secret - or perhaps not-so-secret - fear. Maxine did not appreciate spiders, and wished that the vehicle she was riding had some other name; yet she could handle one if it was really necessary. The creature she could never bear to touch - though she had met it often enough on her diving expeditions - was the shy and harmless octopus.

The whole mountain was now visible, though from directly above it was impossible to appreciate its true height. The two ancient stairways winding up its face might have been oddly twisting level roads; along their entire length, as far as Maxine could observe, there was no sign of life. Indeed, one section had been blocked by a fallen tree - as if Nature had given advance notice, after three thousand years, that she was about to reclaim her own.

Leaving Camera One pointed downwards, Maxine started to pan with Number Two. Fields and forests drifted across the monitor screen, then the distant white domes of Ranapura - then the dark waters of the inland sea. And, presently, there was Yakkagala.

She zoomed on to the Rock, and could just make out the faint pattern of the ruins covering the entire upper surface. The Mirror Wall was still in shadow, as was the Gallery of the Princesses - not that there was any hope of making them out from such a distance. But the layout of the Pleasure Gardens, with their ponds and walkways and massive surrounding moat, was clearly visible.

The line of tiny white plumes puzzled her for a moment, until she realised that she was looking down upon another symbol of Kalidasa's challenge to the Gods - his so-called Fountains of Paradise. She wondered what the king would have thought, could he have seen her rising so effortlessly towards the heaven of his envious dreams.

It was almost a year since she had spoken to Ambassador Rajasinghe. On a sudden impulse she called the Villa.

"Hello, Johan," she greeted him. "How do you like this view of Yakkagala?"

"So you've talked Morgan into it. How does it feel?"

"Exhilarating - that's the only word for it. And unique; I've flown and travelled in everything you can mention, but this feels quite different."

"'To ride secure the cruel sky...'" "What was that?"

"An English poet, early twentieth century - I care not if you bridge the seas,

Or ride secure the cruel sky."

"Well, I care, and I'm feeling secure. Now I can see the whole island - even the Hindustan coast. How high am I, Van?"

"Coming up to twelve kilometres, Maxine. Is your oxygen mask on tight?"

"Confirmed. I hope it's not muffling my voice."

"Don't worry - you're still unmistakeable. Three kilometres to go."

"How much gas is still left in the tank?"

"Sufficient. And if you try to go above fifteen, I'll use the override to bring you home."

"I wouldn't dream of it. And congratulations, by the way - this is an excellent observing platform. You may have customers standing in line."

"We've thought of that - the comsat and metsat people are already making bids. We can give them relays and sensors at any height they like; it will all help to pay the rent."

"I can see you!" exclaimed Rajasinghe suddenly. "Just caught your reflection in the 'scope. Now you're waving your arm... Aren't you lonely up there?"

For a moment there was an uncharacteristic silence. Then Maxine Duval answered quietly: "Not as lonely as Yuri Gagarin must have been, a hundred kilometres higher still. Van, you have brought something new into the world. The sky may still be cruel - but you have tamed it. There may be some people who could never face this ride: I feel very sorry for them."

37 . The Billion-Ton Diamond

In the last seven years much had been done, yet there was still so much to do. Mountains - or at least asteroids - had been moved. Earth now possessed a second natural moon, circling just above synchronous altitude. It was less than a kilometre across, and was rapidly becoming smaller as it was rifled of its carbon and other light elements. Whatever was left - the core of iron, tailings and industrial slag - would form the counterweight that would keep the Tower in tension. It would be the stone in the forty-thousand-kilometre-long sling that now turned with the planet once every twenty-four hours.

Fifty kilometres eastwards of Ashoka Station floated the huge industrial complex which processed the weightless - but not mass-less - megatons of raw material and converted them into hyperfilament. Because the final product was more than ninety percent carbon, with its atoms arranged in a precise crystalline lattice, the Tower had acquired the popular nickname "The Billion Ton Diamond". The Jeweller's Association of Amsterdam had sourly pointed out that (a) hyperfilament wasn't diamond at all (b) if it was, then the Tower weighed five times ten to the fifteen carats.

Carats or tons, such enormous quantities of material had taxed to the utmost the resources of the space colonies and the skills of the orbital technicians. Into the automatic mines, production plants and zero-gravity assembly systems had gone much of the engineering genius of the human race, painfully acquired during two hundred years of spacefaring. Soon all the components of the Tower - a few standardised units, manufactured by the million - would be gathered in huge floating stock-piles, waiting for the robot handlers.

Then the Tower would grow in two opposite directions - down to Earth, and simultaneously up to the orbital mass-anchor, the whole process being adjusted so that it would always be in balance. Its cross-section would decrease steadily from orbit, where it would be under the maximum stress, down to Earth; it would also taper off towards the anchoring counter-weight.

When its task was complete, the entire construction complex would be launched into a transfer orbit to Mars. This was a part of the contract which

had caused some heartburning among terrestrial politicians and financiers now that, belatedly, the space elevator's potential was being realised.

The Martians had driven a hard bargain. Though they would wait another five years before they had any return on their investment, they would then have a virtual construction monopoly for perhaps another decade. Morgan had a shrewd suspicion that the Pavonis tower would merely be the first of several; Mars might have been designed as a location for space elevator systems, and its energetic occupants were not likely to miss such an opportunity. If they made their world the centre of interplanetary commerce in the years ahead, good luck to them; Morgan had other problems to worry about, and some of them were still unsolved.

The Tower, for all its overwhelming size, was merely the support for something much more complex. Along each of its four sides must run thirty-six thousand kilometres of track, capable of operation at speeds never before attempted. This had to be powered for its entire length by super-conducting cables, linked to massive fusion generators, the whole system being controlled by an incredibly elaborate, fail-safe computer network.

The Upper Terminal, where passengers and freight would transfer between the Tower and the spacecraft docked to it, was a major project in itself. So was Midway Station. So was Earth Terminal, now being lasered into the heart of the sacred mountain. And in addition to all this, there was Operation Cleanup...

For two hundred years, satellites of all shapes and sizes, from loose nuts and bolts to entire space villages, had been accumulating in Earth orbit. All that came below the extreme elevation of the Tower, at any time, now had to be accounted for, since they created a possible hazard. Three-quarters of this material was abandoned junk, much of it long forgotten. Now it had to be located, and somehow disposed of.

Fortunately, the old orbital forts were superbly equipped for this task. Their radars - designed to locate oncoming missiles at extreme ranges with no advance warning - could easily pin-point the debris of the early space age. Then their lasers vapourised the smaller satellites, while the larger ones were nudged into higher and harmless orbits. Some, of historic interest, were recovered and brought back to Earth. During this operation there were quite a few surprises - for example, three Chinese astronauts who had perished on some secret mission, and several reconnaissance satellites constructed from such an ingenious mix of components that it was quite impossible to discover what country had launched them. Not, of course, that it now mattered a great deal, since they were at least a hundred years old.

The multitude of active satellites and space stations - forced for operational reasons to remain close to Earth - all had to have their orbits carefully checked, and in some cases modified. But nothing, of course, could be done about the random and unpredictable visitors which might arrive at any minute from the outer reaches of the Solar System. Like all the creations of mankind, the Tower would be exposed to meteorites. Several times a day its network of seismometers would detect milligram impacts; and once or twice a year minor structural damage might be expected. And sooner or later, during the centuries to come, it might encounter a giant which could put one or more tracks out of action for a while. In the worst possible case, the Tower might even be severed somewhere along its length.

That was about as likely to happen as the impact of a large meteorite upon London or Tokyo - which presented roughly the same target area. The inhabitants of those cities did not lose much sleep worrying over this possibility. Nor did Vannevar Morgan. Whatever problems might still lie ahead, no one doubted now that the Orbital Tower was an idea whose time had come.

V - ASCENSION

38. A Place of Silent Storms

(Extract from Professor Martin Sessui's address, on receiving the Nobel Prize for Physics, Stockholm, 16 December 2154.)

Between Heaven and Earth lies an invisible region of which the old philosophers never dreamed. Not until the dawn of the twentieth century - to be precise, on 12 December 1901 - did it make its first impact upon human affairs.

On that day, Guglielmo Marconi radioed the three dots of the Morse letter "S" across the Atlantic. Many experts had declared this to be impossible, as electromagnetic waves could travel only in straight lines, and would be unable to bend round the curve of the globe. Marconi's feat not only heralded the age of world-wide communications, but also proved that, high up in the atmosphere, there exists an electrified mirror, capable of reflecting radio waves back to earth.

The Kennelly-Heaviside Layer, as it was originally named, was soon found to be a region of great complexity, containing at least three main layers, all subject to major variations in height and intensity. At their upper limit they merge into the Van Allen Radiation Belts, whose discovery was the first triumph of the early space age.

This vast region, beginning at a height of approximately fifty kilometres and extending outwards for several radii of the Earth, is now known as the ionosphere; its exploration by rockets, satellites and radio waves has been a continuing process for more than two centuries. I should like to pay a tribute to my precursors in this enterprise - the Americans Tuve and Breit, the Englishman Appleton, the Norwegian Størmer - and, especially, the man who, in 1970, won the very award I am now so honoured to accept, your countryman Hannes Alfvén...

The ionosphere is the wayward child of the sun; even now, its behaviour is not always predictable. In the days when long-range radio depended upon its idiosyncrasies it saved many lives - but more men than we shall ever know were doomed when it swallowed their despairing signals without trace.

For less than one century, before the communications satellites took over, it was our invaluable but erratic servant - a previously unsuspected natural phenomenon, worth countless billions of dollars to the three generations who exploited it.

Only for a brief moment in history was it of direct concern to mankind. And yet - if it had never existed, we should not be here! In one sense, therefore, it was of vital importance even to pre-technological humanity, right back to the first ape-man - indeed, right back to the first living creatures on this planet. For the ionosphere is part of the shield that protects us from the sun's deadly X-ray and ultra-violet radiations. If they had penetrated to sea level, perhaps some kind of life might still have arisen on earth; but it would never have evolved into anything remotely resembling us...

Because the ionosphere, like the atmosphere below it, is ultimately controlled by the sun, it too has its weather. During times of solar disturbance it is blasted by planet-wide gales of charged particles, and twisted into loops and whirls by the earth's magnetic field. On such occasions it is no longer invisible, for it reveals itself in the glowing curtains of the aurora - one of Nature's most awesome spectacles, illuminating the cold polar nights with its eerie radiance.

Even now, we do not understand all the processes occurring in the ionosphere. One reason why it has proved difficult to study is because all our rocket and satellite-borne instruments race through it at thousands of kilometres an hour; we have never been able to stand still to make observations! Now, for the very first time, the construction of the proposed Orbital Tower gives us a chance of establishing fixed observatories in the ionosphere. It is also possible that the Tower may itself modify the characteristics of the ionosphere - though it will certainly not, as Dr. Bickerstaff has suggested, short-circuit it!

Why should we study this region, now that it is no longer important to the communications engineer? Well, apart from its beauty, its strangeness and its scientific interest, its behaviour is closely linked with that of the sun - the master of our destiny. We know now that the sun is not the steady, well-behaved star that our ancestors believed; it undergoes both long and short-period fluctuations. At the present time it is still emerging from the so-called "Maunder Minimum" of 1645 to 1715; as a result, the climate now is milder than at any time since the Early Middle Ages. But how long will this upswing last? Even more important, when will the inevitable downturn begin, and what effect will this have upon climate, weather and every aspect of human civilization - not only on this planet, but on the others as well? For they are all children of the sun...

Some very speculative theories suggest that the sun is now entering a period of instability which may produce a new Ice Age, more universal than any in the past. If this is true, we need every scrap of information we can get to prepare for it. Even a century's warning might not be long enough.

The ionosphere helped to create us; it launched the communications revolution; it may yet determine much of our future. That is why we must continue the study of this vast, turbulent arena of solar and electric forces - this mysterious place of silent storms.

39. The Wounded Sun

The last time that Morgan had seen Dev, his nephew had been a child. Now he was a boy in his early teens; and at their next meeting, at this rate, he would be a man.

The engineer felt only a mild sense of guilt. Family ties had been weakening for the last two centuries: he and his sister had little in common except the accident of genetics. Though they exchanged greetings and small talk perhaps half-a-dozen times a year, and were on the best of terms, he was not even sure when and where they had last met.

Yet when he greeted the eager, intelligent boy (not in the least overawed, it seemed, by his famous uncle) Morgan was aware of a certain bitter-sweet wistfulness. He had no son to continue the family name; long ago, he had made that choice between Work and Life which can seldom be avoided at the highest levels of human endeavour. On three occasions - not including the liaison with Ingrid - he might have taken a different path; but accident or ambition had deflected him.

He knew the terms of the bargain he had made, and he accepted them; it was too late now to grumble about the small print. Any fool could shuffle genes, and most did. But whether or not History gave him credit, few men could have achieved what he had done - and was about to do.

In the last three hours, Dev had seen far more of Earth Terminus than any of the usual run of VIPs. He had entered the mountain at ground level, along the almost completed approach to the South Station, and had been given the quick tour of the passenger and baggage handling facilities, the control centre, and the switching yard where capsules would be routed from the East and West DOWN tracks to the North and South up ones. He had stared up the five-kilometre-long shaft - like a giant gun barrel aimed at the stars, as several hundred reporters had already remarked in hushed voices - along which the lines of traffic would rise and descend. And his questions had exhausted three guides before the last one had thankfully handed him over to his uncle.

"Here he is, Van," said Warren Kingsley as they arrived via the high-speed elevator at the truncated summit of the mountain. "Take him away before he grabs my job."

"I didn't know you were so keen on engineering, Dev."

The boy looked hurt, and a little surprised. "Don't you remember, Uncle - that No 12 Meccamax you gave me on my tenth birthday?"

"Of course - of course. I was only joking." (And, to tell the truth, he had not really forgotten the construction set; it had merely slipped his mind for the moment.) "You're not cold up here?" Unlike the well-protected adults, the boy had disdained the usual light thermocoat.

"No - I'm fine. What kind of jet is that? When are you going to open up the shaft? Can I touch the tapes?"

"See what I mean?" chuckled Kingsley.

"One: that's Sheik Abdullah's Special - his son Feisal is visiting. Two: we'll keep this lid on until the Tower reaches the mountain and enters the shaft - we need it as a working platform, and it keeps out the rain. Three: you can touch the tapes if you want to - don't run - it's bad for you at this altitude!"

"If you're twelve, I doubt it," said Kingsley towards Dev's rapidly receding back. Taking their time, they caught up with him at the East Face anchor.

The boy was staring, as so many thousands of others had already done, at the narrow band of dull grey that rose straight out of the ground and soared vertically into the sky. Dev's gaze followed it up - up - up - until his head was tilted as far back as it would go. Morgan and Kingsley did not follow suit, though the temptation, after all these years, was still strong. Nor did they warn him that some visitors got so giddy that they collapsed and were unable to walk away without assistance.

The boy was tough: he gazed intently at the zenith for almost a minute, as if hoping to see the thousands of men and millions of tons of material poised there beyond the deep blue of the sky. Then he closed his eyes with a grimace, shook his head, and looked down at his feet for an instant, as if to reassure himself that he was still on the solid, dependable earth.

He reached out a cautious hand, and stroked the narrow ribbon linking the planet with its new moon.

"What would happen," he asked, "if it broke?"

That was an old question; most people were surprised at the answer.

"Very little. At this point, it's under practically no tension. If you cut the tape it would just hang there, waving in the breeze."

Kingsley made an expression of distaste; both knew, of course, that this was a considerable over-simplification. At the moment, each of the four tapes was stressed at about a hundred tons - but that was negligible compared to the design loads they would be handling when the system was in operation and they had been integrated into the structure of the Tower. There was no point, however, in confusing the boy with such details.

Dev thought this over; then he gave the tape an experimental flick, as if he hoped to extract a musical note from it. But the only response was an unimpressive "click" that instantly died away.

"If you hit it with a sledge-hammer," said Morgan, "and came back about ten hours later, you'd be just in time for the echo from Midway."

"Not any longer," said Kingsley. "Too much damping in the system."

"Don't be a spoil-sport, Warren. Now come and see something really interesting."

They walked to the centre of the circular metal disc that now capped the mountain and sealed the shaft like a giant saucepan lid. Here, equidistant from the four tapes down which the Tower was being guided earthwards, was a small geodesic hut, looking even more temporary than the surface on which it had been erected. It housed an oddly-designed telescope, pointing straight upwards and apparently incapable of being aimed in any other direction.

"This is the best time for viewing, just before sunset; then the base of the Tower is nicely lit up."

"Talking of the sun," said Kingsley, "just look at it now. It's even clearer than yesterday." There was something approaching awe in his voice, as he pointed at the brilliant flattened ellipse sinking down into the western haze. The horizon mists had dimmed its glare so much that one could stare at it in comfort.

Not for more than a century had such a group of Spots appeared; they stretched across almost half the golden disc, making it seem as if the sun had been stricken by some malignant disease, or pierced by falling worlds. Yet not even mighty Jupiter could have created such a wound in the solar atmosphere; the largest spot was a quarter of a million kilometres across, and could have swallowed a hundred Earths.

"There's another big auroral display predicted for tonight - Professor Sessui and his merry men certainly timed it well."

"Let's see how they're getting on," said Morgan, as he made some adjustments to the eye-piece. "Have a look, Dev."

The boy peered intently for a moment, then answered: "I can see the four tapes, going inwards - I mean upwards - until they disappear."

"Nothing in the middle?"

Another pause. "No - not a sign of the Tower."

"Correct - it's still six hundred kilometres up, and we're on the lowest power of the telescope. Now I'm going to zoom. Fasten your seatbelt."

Dev gave a little laugh at the ancient cliché, familiar from dozens of historical dramas. Yet at first he could see no alteration, except that the four lines pointing towards the centre of the field were becoming a little less sharp. It took him a few seconds to realise that no change could be expected as his point of view hurtled upwards along the axis of the system; the quartet of tapes would look exactly the same at any point along its length.

Then, quite suddenly, it was there, taking him by surprise even though he had been expecting it. A tiny bright spot had materialised in the exact centre of the field; it was expanding as he watched it, and now for the first time he had a real sensation of speed.

A few seconds later, he could make out a small circle - no, now both brain and eye agreed that it was a square. He was looking directly up at the base of the Tower, crawling earthwards along its guiding tapes at a couple of kilometres a day. The four tapes had now vanished, being far too small to be visible at this distance. But that square fixed magically in the sky continued to grow, though now it had become fuzzy under the extreme magnification.

"What do you see?" asked Morgan.

"A bright little square."

"Good - that's the underside of the tower, still in full sunlight. When it's dark down here you can see it with the naked eye for another hour before it enters the earth's shadow. Now, do you see anything else?"

"Nooo..." replied the boy, after a long pause.

"You should. There's a team of scientists visiting the lowest section to set up some research equipment. They've just come down from Midway. If you look carefully you'll see their transporter - it's on the south track - that will be the right side of the picture. Look for a bright spot, about a quarter the size of the Tower."

"Sorry, Uncle - I can't find it. You have a look."

"Well, the seeing may have got worse. Sometimes the Tower disappears completely though the atmosphere may look -"

Even before Morgan could take Dev's place at the eyepiece, his personal receiver gave two shrill double beeps. A second later, Kingsley's alarm also erupted.

It was the first time the Tower had ever issued a four-star emergency alert.

40. The End of the Line

No wonder they called it the "Transiberian Railway". Even on the easy downhill run, the journey from Midway Station to the base of the Tower lasted fifty hours.

One day it would take only five, but that still lay two years in the future, when the tracks were energised and their magnetic fields activated. The inspection and maintenance vehicles that now ran up and down the faces of the Tower were propelled by old-fashioned tyres, gripping the interior of the guidance slots. Even if the limited power of the batteries permitted, it was not safe to operate such a system at more than five hundred kilometres an hour.

Yet everyone had been far too busy to be bored. Professor Sessui and his three students had been observing, checking their instruments, and making sure that no time would be wasted when they transferred into the Tower. The capsule driver, his engineering assistant, and the one steward who comprised the entire cabin staff were also fully occupied, for this was no routine trip. The "Basement", twenty-five thousand kilometres below Midway - and now only six hundred kilometres from Earth - had never been visited since it was built. Until now, there had been no purpose in going there, since the handful of monitors had never reported anything amiss. Not that there was much to go wrong, as the Basement was merely a fifteen-metre-square pressurised chamber - one of the scores of emergency refuges at intervals along the Tower.

Professor Sessui had used all his considerable influence to borrow this unique site, now crawling down through the ionosphere at two kilometres a day towards its rendezvous with Earth. It was essential, he had argued forcibly, to get his equipment installed before the peak of the current sunspot maximum.

Already, solar activity had reached unprecedented levels, and Sessui's young assistants often found it hard to concentrate on their instruments; the magnificent auroral displays outside were too much of a distraction. For hours on end, both northern and southern hemispheres were filled with slowly moving curtains and streamers of greenish light, beautiful and awe-inspiring - yet only

a pale ghost of the celestial firework displays taking place around the poles. It was rare indeed for the aurora to wander so far from its normal domains; only once in generations did it invade the equatorial skies.

Sessui had driven his students back to work with the admonition that they would have plenty of time for sight-seeing during the long climb back to Midway. Yet it was noticeable that even the Professor himself sometimes stood at the observation window for minutes at a time, entranced by the spectacle of the burning heavens.

Someone had christened the project "Expedition to Earth" - which, as far as distance was concerned, was ninety-eight percent accurate. As the capsule crawled down the face of the Tower at its miserable five hundred klicks, the increasing closeness of the planet beneath made itself obvious. For gravity was slowly increasing, from the delightful less-than-lunar buoyancy of Midway to almost its full terrestrial value. To any experienced space traveller, this was strange indeed: feeling any gravity before the moment of atmospheric entry seemed a reversal of the normal order of things.

Apart from complaints about the food, stoically endured by the overworked steward, the journey had been devoid of incident. A hundred kilometres from the Basement, the brakes had been gently applied and speed had been halved. It was halved again at fifty kilometers - for, as one of the students remarked: "Wouldn't it be embarrassing if we ran off the end of the track?"

The driver (he insisted on being called pilot) retorted that this was inpossible, as the guidance slots down which the capsule was falling terminated several metres short of the Tower's end; there was also an elaborate buffer system, just in case all four independent sets of brakes failed to work. And everyone agreed that the joke, besides being perfectly ridiculous, was in extremely poor taste.

41. Meteor

The vast artificial lake known for two thousand years as the Sea of Paravana lay calm and peaceful beneath the stone gaze of its builder. Though few now visited the lonely statue of Kalidasa's father, his work, if not his fame, had outlasted that of his son; and it had served his country infinitely better, bringing food and drink to a hundred generations of men. And to many more generations of birds, deer, buffalo, monkeys and their predators, like the sleek and well-fed leopard now drinking at the water's edge. The big cats were becoming rather too common and were inclined to be a nuisance, now that they no longer had anything to fear from hunters. But they never attacked men, unless they were cornered or molested.

Confident of his security, the leopard was leisurely drinking his fill, as the shadows round the lake lengthened and twilight advanced from the east. Suddenly, he pricked up his ears and became instantly alert; but no mere human senses could have detected any change in land, water or sky. The evening was as tranquil as ever.

And then, directly out of the zenith, came a faint whistling that grew steadily to a rumbling roar, with tearing, ripping undertones, quite unlike that

of a re-entering spacecraft. Up in the sky something metallic was sparkling in the last rays of the sun, growing larger and larger and leaving a trail of smoke behind it. As it expanded, it disintegrated; pieces shot off in all directions, some of them burning as they did so. For a few seconds an eye as keen as the leopard's might have glimpsed a roughly cylindrical object, before it exploded into a myriad fragments. But the leopard did not wait for the final catastrophe; it had already disappeared into the jungle.

The Sea of Paravana erupted in sudden thunder. A geyser of mud and spray shot a hundred metres into the air - a fountain far surpassing those of Yakkagala, and one indeed almost as high as the Rock itself. It hung suspended for a moment in futile defiance of gravity, then tumbled back into the shattered lake.

Already, the sky was full of waterfowl wheeling in startled flight. Almost as numerous, flapping among them like leathery pterodactyls who had somehow survived into the modern age, were the big fruit-bats who normally took to the air only after dusk. Now, equally terrified, birds and bats shared the sky together.

The last echoes of the crash died away into the encircling jungle; silence swiftly returned to the lake. But long minutes passed before its mirror surface was restored and the little waves ceased to scurry back and forth beneath the unseeing eyes of Paravana the Great.

42. Death in Orbit

Every large building, it is said, claims a life; fourteen names were engraved on the piers of the Gibraltar Bridge. But thanks to an almost fanatical safety campaign, casualties on the Tower had been remarkably low. There had, indeed, been one year without a single death.

And there had been one year with four - two of them particularly harrowing. A space-station assembly supervisor, accustomed to working under zero gravity, had forgotten that though he was in space he was not in orbit - and a life-time's experience had betrayed him. He had plummeted more than fifteen thousand kilometres, to burn up like a meteor upon entry into the atmosphere. Unfortunately his suit radio had remained switched on during those last few minutes...

It was a bad year for the Tower; the second tragedy had been much more protracted, and equally public. An engineer on the counterweight, far beyond synchronous orbit, had failed to fasten her safety belt properly - and had been flicked off into space like a stone from a sling. She was in no danger, at this altitude, either of falling back to earth or of being launched on an escape trajectory; unfortunately her suit held less than two hours' air. There was no possibility of rescue at such short notice; and despite a public outcry, no attempt was made. The victim had co-operated nobly. She had transmitted her farewell messages, and then - with thirty minutes of oxygen still unused - had opened her suit to vacuum. The body was recovered a few days later, when the inexorable laws of celestial mechanics brought it back to the perigee of its long ellipse.

These tragedies flashed through Morgan's mind as he took the highspeed elevator down to the Operations Room, closely followed by a sombre Warren Kingsley and the now almost forgotten Dev. But this catastrophe was of an altogether different type, involving an explosion at or near the Basement of the Tower. That the transporter had fallen to earth was obvious, even before the garbled report had been received of a "giant meteor shower" somewhere in central Taprobane.

It was useless to speculate until he had more facts; and in this case, where all the evidence had probably been destroyed, they might never be available. He knew that space accidents seldom had a single cause; they were usually the result of a chain of events, often quite harmless in themselves. All the foresight of the safety engineers could not guarantee absolute reliability, and sometimes their own over-elaborate precautions contributed to disaster. Morgan was not ashamed of the fact that the safety of the project now concerned him far more than any loss of life. Nothing could be done about the dead, except to ensure that the same accident could never happen again. But that the almost completed Tower might be endangered was a prospect too appalling to contemplate.

The elevator floated to a halt, and he stepped out into the Operations Room - just in time for the evening's second stunning surprise.

43. Fail-Safe

Five kilometres from the terminus, driver-pilot Rupert Chang had reduced speed yet again. Now, for the first time, the passengers could see the face of the Tower as something more than a featureless blur dwindling away to infinity in both directions. Upwards, it was true, the twin grooves along which they were riding still stretched forever-or at least for twenty-five thousand kilometres, which on the human scale was much the same. But downwards, the end was already in sight. The truncated base of the Tower was clearly silhouetted against the verdant green background of Taprobane, which it would reach and unite with in little more than a year.

Across the display panel, the red ALARM symbols flashed yet again. Chang studied them with a frown of annoyance, then pressed the RESET button. They flickered once, then vanished.

The first time this had happened, two hundred kilometres higher, there had been a hasty consultation with Midway Control. A quick check of all systems had revealed nothing amiss; indeed, if all the warnings were to be believed, the transporter's passengers were already dead. Everything had gone outside the limits of tolerance.

It was obviously a fault in the alarm circuits themselves, and Professor Sessui's explanation was accepted with general relief. The vehicle was no longer in the pure vacuum environment for which it had been designed; the ionospheric turmoil it had now entered was triggering the sensitive detectors of the warning systems.

"Someone should have thought of that," Chang had grumbled. But, with less than an hour to go, he was not really worried. He would make constant manual

checks of all the critical parameters; Midway approved, and in any case there was no alternative.

Battery condition was, perhaps, the item that concerned him most. The nearest charging point was two thousand kilometres higher up, and if they couldn't climb back to that they would be in trouble. But Chang was quite happy on this score; during the braking process the transporter's drive-motors had been functioning as dynamos, and ninety percent of its gravitational energy had been pumped back into the batteries. Now that they were fully charged, the surplus hundreds of kilowatts still being generated should be diverted into space through the big cooling fins at the rear. Those fins, as Chang's colleagues had often pointed out to him, made his unique vehicle look rather like an old-time aerial bomb. By this time, at the very end of the braking process, they should have been glowing a dull red. Chang would have been very worried indeed had he known that they were still comfortably cool. For energy can never be destroyed; it has to go somewhere. And very often it goes to the wrong place.

When the FIRE-BATTERY COMPARTMENT Sign came on for the third time, Chang did not hesitate to reset it. A real fire, he knew, would have triggered the extinguishers; in fact, one of his biggest worries was that these might operate unnecessarily. There were several anomalies on the board now, especially in the battery-charging circuits. As soon as the journey was over and he had powered down the transporter, Chang was going to climb into the motor-room and give everything a good old-fashioned eyeball inspection.

As it happened, his nose alerted him first, when there was barely more than a kilometre to go. Even as he stared incredulously at the thin wisp of smoke oozing out of the control board, the coldly analytical part of his mind was saying: "What a lucky coincidence that it waited until the end of the trip!"

Then he remembered all the energy being produced during the final braking, and had a pretty shrewd guess at the sequence of events. The protective circuits must have failed to operate, and the batteries had been overcharging. One fail-safe after another had let them down; helped by the ionospheric storm, the sheer perversity of inanimate things had struck again.

Chang punched the battery compartment fire-extinguisher button; at least that worked, for he could hear the muffled roar of the nitrogen blasts on the other side of the bulkhead. Ten seconds later, he triggered the VACUUM DUMP which would sweep the gas out into space - with, hopefully, most of the heat it had picked up from the fire. That too operated correctly; it was the first time that Chang had ever listened with relief to the unmistakeable shriek of atmosphere escaping from a space vehicle; he hoped it would also be the last.

He dared not rely on the automatic braking sequence as the vehicle finally crawled into the terminus; fortunately, he had been well rehearsed and recognised all the visual signals, so that he was able to stop within a centimetre of the docking adapter. In frantic haste, the airlocks were coupled together, and stores and equipment were hurled through the connecting tube...

And so was Professor Sessui, by the combined exertions of pilot, assistant engineer and steward, when he tried to go back for his precious instruments. The airlock doors were slammed shut just seconds before the engine compartment bulkhead finally gave way.

After that, the refugees could do nothing but wait in the bleak, fifteen-metre square chamber, with considerably fewer amenities than a well-furnished prison cell, and hope that the fire would burn itself out. Perhaps it was well for the passengers' peace of mind that only Chang and his engineer appreciated one vital statistic: the fully-charged batteries contained the energy of a large chemical bomb, now ticking away on the outside of the Tower.

Ten minutes after their hasty arrival, the bomb went off. There was a muffled explosion, which caused only slight vibrations of the Tower, followed by the sound of ripping and tearing metal. Though the breaking-up noises were not very impressive, they chilled the hearts of the listeners; their only means of transport was being destroyed, leaving them stranded twenty-five thousand kilometres from safety.

There was another, more protracted explosion - then silence; the refugees guessed that the vehicle had fallen off the face of the Tower. Still numbed, they started to survey their resources; and, slowly, they began to realise that their miraculous escape might have been wholly in vain.

44. A Cave in the Sky

Deep inside the mountain, amid the display and communications equipment of the Earth Operations Centre, Morgan and his engineering staff stood around the tenth-scale hologram of the Tower's lowest section. It was perfect in every detail, even to the four thin ribbons of the guiding tapes extending along each face. They vanished into thin air just above the floor, and it was hard to appreciate that, even on this diminished scale, they should continue downwards for another sixty kilometers - completely through the crust of the earth.

"Give us the cutaway," said Morgan, "and lift the Basement up to eye level."

The Tower lost its apparent solidity and became a luminous ghost - a long, thin-walled square box, empty except for the superconducting cables of the power supply. The very lowest section - the "Basement" was indeed a good name for it, even if it was at a hundred times the elevation of this mountain - had been sealed off to form a single square chamber, fifteen metres on a side.

"Access?" queried Morgan.

Two sections of the image started to glow more brightly. Clearly defined on the north and south faces, between the slots of the guidance tracks, were the outer doors of the duplicate airlocks - as far apart as possible, according to the usual safety precautions for all space habitats.

"They went in through the south door, of course," explained the Duty Officer. "We don't know if it was damaged in the explosion."

Well, there were three other entrances, thought Morgan - and it was the lower pair that interested him. This had been one of those afterthoughts, incorporated at a late stage in the design. Indeed, the whole Basement was an afterthought; at one time it had been considered unnecessary to build a refuge here, in the section of the Tower that would eventually become part of Earth Terminus itself.

"Tilt the underside towards me," Morgan ordered.

The Tower toppled, in a falling arc of light, and lay floating horizontally in mid-air with its lower end towards Morgan. Now he could see all the details of the twenty-metre-square floor - or roof, if one looked at it from the point of view of its orbital builders.

Near the north and south edges, leading into the two independent airlocks, were the hatches that allowed access from below. The only problem was to reach them - six hundred kilometres up in the sky.

"Life support?"

The airlocks faded back into the structure; the visual emphasis moved to a small cabinet at the centre of the chamber.

"That's the problem, Doctor," the Duty Officer answered sombrely. "There's only a pressure maintenance system. No purifiers, and of course no power. Now that they've lost the transporter, I don't see how they can survive the night. The temperature's already falling - down ten degrees since sunset."

Morgan felt as if the chill of space had entered his own soul. The euphoria of discovering that the lost transporter's occupants were all still alive faded swiftly away. Even if there was enough oxygen in the Basement to last them for several days, that would be of no importance if they froze before dawn.

"I'd like to speak to Professor Sessui."

"We can't call him direct - the Basement emergency phone only goes to Midway. No problem, though."

That turned out to be not completely true. When the connexion was made, Driver-Pilot Chang came on the line.

"I'm sorry," he said, "the Professor is busy."

After a moment's incredulous silence Morgan replied, pausing between each word and emphasising his name: "Tell him that Dr. Vannevar Morgan wants to speak to him."

"I will, Doctor - but it won't make the slightest difference. He's working on some equipment with his students. It was the only thing they were able to save - a spectroscope of some kind - they're aiming it through one of the observation windows..."

Morgan controlled himself with difficulty. He was about to retort: "Are they crazy?", when Chang anticipated him.

"You don't know the Prof - I've spent the last week with him. He's - well, I guess you could say single-minded. It took three of us to stop him going back into the cabin to get some more of his gear. And he's just told me that if we're all going to die anyway, he'll make damn sure that one piece of equipment is working properly."

Morgan could tell from Chang's voice that, for all his annoyance, he felt a considerable admiration for his distinguished and difficult passenger. And,

indeed, the Professor had logic on his side. It made good sense to salvage what he could, out of the years of effort that had gone into this ill-fated expedition.

"Very well," said Morgan at length, co-operating with the inevitable. "Since I can't get an appointment, I'd like your summary of the situation. So far, I've only had it secondhand."

It now occurred to him that, in any event, Chang could probably give a much more useful report than the Professor. Though the driver-pilot's insistence on the second half of his title often caused derision among genuine astrologers, he was a highly skilled technician with a good training in mechanical and electrical engineering.

"There's not much to say. We had such short notice that there was no time to save anything - except that damned spectrometer. Frankly, I never thought we'd make it through the airlock. We have the clothes we're wearing - and that's about it. One of the students grabbed her travel bag. Guess what - it contained her draft thesis, written on paper, for heaven's sake! Not even flame-proofed, despite regulations. If we could afford the oxygen, we'd burn it to get some heat."

Listening to that voice from space, and looking at the transparent - yet apparently solid - hologram of the Tower, Morgan had a most curious illusion. He could imagine that there were tiny, tenth-scale human beings moving around there in the lowest compartment; it was only necessary to reach in his hand, and carry them out to safety...

"Next to the cold, the big problem is air. I don't know how long it will be before CO2 build-up knocks us out - perhaps someone will work out that as well. Whatever the answer, I'm afraid it will be too optimistic." Chang's voice dropped several decibels and he began to speak in an almost conspiratorial tone, obviously to prevent being overheard. "The Prof and his students don't know this, but the south airlock was damaged in the explosion. There's a leak - a steady hiss round the gaskets. How serious it is, I can't tell." The speaker's voice rose to normal level again. "Well, that's the situation. We'll be waiting to hear from you."

And just what the hell can we say, Morgan thought to himself except "Goodbye"?

Crisis-management was a skill which Morgan admired but did not envy. Janos Bartok, the Tower Safety Officer up at Midway, was now in charge of the situation; those inside the mountain twenty-five thousand kilometres below - and a mere six hundred from the scene of the accident - could only listen to the reports, give helpful advice, and satisfy the curiosity of the news media as best they could.

Needless to say, Maxine Duval had been in touch within minutes of the disaster, and as usual her questions were very much to the point.

"Can Midway Station reach them in time?"

Morgan hesitated; the answer to that was undoubtedly "No". Yet it was unwise, not to say cruel, to abandon hope as early as this. And there had been one stroke of good luck...

"I don't want to raise false hopes, but we may not need Midway. There's a crew working much closer, at the 10K - ten-thousand-kilometre - Station. Their transporter can reach the Basement in twenty hours.'

"Then why isn't it on the way down?"

"Safety Officer Bartok will be making the decision shortly - but it could be a waste of effort. We think they have air for only half that time. And the temperature problem is even more serious."

"What do you mean?"

"It's night up there, and they have no source of heat. Don't put this out yet, Maxine, but it may be a race between freezing and anoxia."

There was a pause for several seconds; then Maxine Duval said in an uncharacteristically diffident tone of voice: "Perhaps I'm being stupid, but surely the weather stations with their big infrared lasers -"

"Thank you, Maxine - I'm the one who's being stupid. Just a minute while I speak to Midway..."

Bartok was polite enough when Morgan called, but his brisk reply made his opinion of meddling amateurs abundantly clear.

"Sorry I bothered you," apologised Morgan, and switched back to Maxine. "Sometimes the expert does know his job," he told her with rueful pride. "Our man knows his. He called Monsoon Control ten minutes ago. They're computing the beam power now - they don't want to overdo it, of course, and burn everybody up." "So I was right," said Maxine sweetly. "You should have thought of that, Van. What else have you forgotten?"

No answer was possible, nor did Morgan attempt one. He could see Maxine's computer-mind racing ahead, and guessed what her next question would be. He was right.

"Can't you use the Spiders?"

"Even the final models are altitude-limited - their batteries can only take them up to three hundred kilometres. They were designed to inspect the Tower, when it had already entered the atmosphere."

"Well, put in bigger batteries."

"In a couple of hours? But that's not the problem. The only unit under test at the moment can't carry passengers."

"You could send it up empty."

"Sorry - we've thought of that. There must be an operator aboard to manage the docking, when the Spider comes up to the Basement. And it would still take days to get out seven people, one at a time."

"Surely you have some plan !"

"Several, but they're all crazy. If any make sense, I'll let you know. Meanwhile, there's something you can do for us."

"What's that?" Maxine asked suspiciously.

"Explain to your audience just why spacecraft can dock with each other six hundred kilometres up - but not with the Tower. By the time you've done that, we may have some news for you."

As Maxine's slightly indignant image faded from the screen, and Morgan turned back once more to the well-orchestrated chaos of the Operations Room, he tried to let his mind roam as freely as possible over every aspect of the problem. Despite the polite rebuff of the Safety Officer, efficiently doing his duty up on Midway, he might be able to think of some useful ideas. Although he did not imagine that there would be any magical solution, he understood the Tower better than any living man - with the possible exception of Warren Kingsley. Warren probably knew more of the fine details; but Morgan had the clearer overall picture.

Seven men and women were stranded in the sky, in a situation that was unique in the whole history of space technology. There must be a way of getting to safety, before they were poisoned by CO2, or the pressure dropped so low that the chamber became, in literal truth, a tomb like Mahomet's - suspended between Heaven and Earth.

45. The Man for the Job

"We can do it," said Warren Kingsley with a broad smile. "Spider can reach the Basement."

"You've been able to add enough extra battery power?"

"Yes, but it's a very close thing. It will have to be a two-stage affair, like the early rockets. As soon as the battery is exhausted, it must be jettisoned to get rid of the dead weight. That will be around four hundred kilometres; Spider's internal battery will take it the rest of the way."

"And how much payload will that give?"

Kingsley's smile faded.

"Marginal. About fifty kilos, with the best batteries we have."

"Only fifty! What use will that be?"

"It should be enough. A couple of those new thousand-atmosphere tanks, each holding five kilos of oxygen. Molecular filter masks to keep out the CO2. A little water and compressed food. Some medical supplies. We can bring it all in under forty-five kilos."

"Phew! And you're sure that's sufficient?"

"Yes - it will tide them over until the transporter arrives from the 10K Station. And if necessary Spider can make a second trip."

"What does Bartok think?"

"He approves. After all, no one has any better ideas."

Morgan felt that a great weight had been lifted from his shoulders. Plenty of things could still go wrong, but at last there was a ray of hope; the feeling of utter helplessness had been dispelled.

"When will all this be ready?" he asked.

"If there are no hold-ups, within two hours. Three at the most. It's all standard equipment, luckily. Spider's being checked out right now. There's only one matter still to be decided..."

Vannevar Morgan shook his head. "No, Warren," he answered slowly, in a calm, implacably determined voice that his friend had never heard before. "There's nothing more to decide."

"I'm not trying to pull rank on you, Bartok," said Morgan. "It's a simple matter of logic. True, anyone can drive Spider - but only half-a-dozen men know all the technical details involved. There may be some operational problems when we reach the Tower, and I'm in the best position to solve them."

"May I remind you, Dr. Morgan," said the Safety Officer, "that you are sixty-five. It would be wiser to send a younger man."

"I'm not sixty-five; I'm sixty-six. And age has absolutely nothing to do with it. There's no danger, and certainly no requirement for physical strength."

And, he might have added, the psychological factors were far more important than the physical ones. Almost anybody could ride passively up and down in a capsule, as Maxine Duval had done and millions of others would be doing in the years ahead. It would be quite another matter to face some of the situations that could easily arise, six hundred kilometres up in the empty sky.

"I still think," said Safety Officer Bartok with gentle persistence, "that it would be best to send a younger man. Dr. Kingsley, for example."

Behind him, Morgan heard (or had he imagined?) his colleague's suddenly indrawn breath. For years they had joked over the fact that Warren had such an aversion to heights that he never inspected the structures he designed. His fear fell short of genuine acrophobia, and he could overcome it when absolutely necessary; he had, after all, joined Morgan in stepping from Africa to Europe. But that was the only time that anyone had ever seen him drunk in public, and he was not seen at all for twenty-four hours afterwards.

Warren was out of the question, even though Morgan knew that he would be prepared to go. There were times when technical ability and sheer courage were not enough; no man could fight against fears that had been implanted in him at his birth, or during his earliest childhood.

Fortunately, there was no need to explain this to the Safety Officer. There was a simpler and equally valid reason why Warren should not go. Only a very few times in his life had Vannevar Morgan been glad of his small size; this was one of them.

"I'm fifteen kilos lighter than Kingsley," he told Bartok. "In a marginal operation like this, that should settle the matter. So let's not waste any more precious time in argument."

He felt a slight twinge of conscience, knowing that this was unfair. Bartok was only doing his job, very efficiently, and it would be another hour before the capsule was ready. No one was wasting any time.

For long seconds the two men stared into each other's eyes as if the twenty-five thousand kilometres between them did not exist. If there was a direct trial of strength, the situation could be messy. Bartok was nominally in charge of all safety operations, and could theoretically over-rule even the Chief Engineer and Project Manager. But he might find it difficult to enforce his authority; both Morgan and Spider were far below him on Sri Kanda, and possession was nine points of the law.

Bartok shrugged his shoulders, and Morgan relaxed.

"You have a point. I'm still not too happy, but I'll go along with you. Good luck."

"Thank you," Morgan answered quietly, as the image faded from the screen. Turning to the still silent Kingsley, he said:

"Let's go."

Only as they were leaving the Operations Room on the way back to the summit did Morgan automatically feel for the little pendant concealed beneath his shirt. CORA had not bothered him for months, and not even Warren Kingsley knew of her existence. Was he gambling with other lives as well as his own, just to satisfy his own selfish pride? If Safety Officer Bartok had known about this...

It was too late now. Whatever his motives, he was committed.

46. Spider

How the mountain had changed, thought Morgan, since he had first seen it! The summit had been entirely sheared away, leaving a perfectly level plateau; at its centre was the giant "saucepan lid", sealing the shaft which would soon carry the traffic of many worlds. Strange to think that the greatest spaceport in the solar system would be deep inside the heart of a mountain.

No one could have guessed that an ancient monastery had once stood here, focusing the hopes and fears of billions for at least three thousand years. The only token that still remained was the ambiguous bequest of the Maha Thero, now crated and waiting to be moved. But, so far, neither the authorities at Yakkagala nor the director of the Ranapura Museum had shown much enthusiasm for Kalidasa's ill-omened bell. The last time it had tolled the peak had been swept by that brief but eventful gale - a wind of change indeed. Now the air was almost motionless, as Morgan and his aides walked slowly to the waiting capsule, glittering beneath the inspection lights. Someone had stencilled the name SPIDER MARK II on the lower part of the housing; and beneath that had been scrawled the promise: WE DELIVER THE GOODS. I hope so, thought Morgan.

Every time he came here he found it more difficult to breathe, and he looked forward to the flood of oxygen that would soon gush into his starved lungs. But CORA, to his surprised relief, had never issued even a preliminary admonition when he visited the summit; the regime that Dr. Sen had prescribed seemed to be working admirably.

Everything had been loaded aboard Spider, which had been jacked up so that the extra battery could be hung beneath it. Mechanics were still making hasty last-minute adjustments and disconnecting power leads; the tangle of cabling underfoot was a mild hazard to a man unused to walking in a spacesuit.

Morgan's Flexisuit had arrived from Gagarin only thirty minutes ago, and for a while he had seriously considered leaving without one. Spider Mark II was a far more sophisticated vehicle than the simple prototype that Maxine Duval had once ridden; indeed, it was a tiny spaceship with its own life-support system. If all went well, Morgan should be able to mate it with the airlock on the bottom of the Tower, designed years ago for this very purpose. But a suit would provide not only insurance in case of docking problems; it would give him enormously greater freedom of action. Almost form-fitting, the Flexisuit bore very little resemblance to the clumsy armour of the early astronauts, and, even when pressurised, would scarcely restrict his movements. He had once seen a demonstration by its manufacturers of some spacesuited acrobatics, culminating in a sword-fight and a ballet. The last was hilarious - but it had proved the designer's claims.

Morgan climbed the short flight of steps, stood for a moment on the capsule's tiny metal porch, then cautiously backed inside. As he settled down and fastened the safety belt, he was agreeably surprised at the amount of room. Although the Mark II was certainly a one-man vehicle, it was not as claustrophobic as he had feared - even with the extra equipment that had been packed into it.

The two oxygen cylinders had been stowed under the seat, and the CO2 masks were in a small box behind the ladder that led up to the overhead airlock. It seemed astonishing that such a small amount of equipment could mean the difference between life and death for so many people.

Morgan had taken one personal item - a memento of that first day long ago at Yakkagala, where in a sense all this had started. The spinnerette took up little room, and weighed only a kilo. Over the years it had become something of a talisman; it was still one of the most effective ways of demonstrating the properties of hyperfilament, and whenever he left it behind he almost invariably found that he needed it. On this, of all trips, it might well prove useful.

He plugged in the quick-release umbilical of his spacesuit, and tested the air-flow both on the internal and external supply. Outside, the power cables were disconnected; Spider was on its own.

Brilliant speeches were seldom forthcoming at such moments - and this, after all, was going to be a perfectly straightforward operation. Morgan grinned rather stiffly at Kingsley and said: "Mind the store, Warren, until I get back." Then he noticed the small, lonely figure in the crowd around the capsule. My God, he thought to himself - I'd almost forgotten the poor kid. . . "Dev," he called. "Sorry I haven't been able to look after you. I'll make up for it when I get back."

And I will, he told himself. When the Tower was finished there would be time for everything - even the human relations he had so badly neglected. Dev would be worth watching; a boy who knew when to keep out of the way showed unusual promise.

The curving door of the capsule - the upper half of it transparent plastic - thudded softly shut against its gaskets. Morgan pressed the CHECK-OUT button, and Spider's vital statistics appeared on the screen one by one. All were green; there was no need to note the actual figures. If any of the values had been outside nominal, they would have flashed red twice a second. Nevertheless, with his usual engineer's caution, Morgan observed that oxygen stood at 102 percent, main battery power at 101 percent, booster battery at 105 percent. ..

The quiet, calm voice of the controller - the same unflappable expert who had watched over all operations since that first abortive lowering years ago - sounded in his ear. "All systems nominal. You have control."

"I have control. I'll wait until the next minute comes up."

It was hard to think of a greater contrast to an old-time rocket launch, with its elaborate countdown, its split-second timing, its sound and fury. Morgan merely waited until the last two digits on the clock became zeroes, then switched on power at the lowest setting.

Smoothly - si1ently -- the flood-lit mountain top fell away beneath him. Not even a balloon ascent could have been quieter. If he listened carefully he could just hear the whirring of the twin motors as they drove the big friction drive-wheels that gripped the tape, both above and below the capsule.

Rate of ascent, five metres a second, said the velocity indicator; in slow, regular steps Morgan increased the power until it read fifty - just under two hundred kilometres an hour. That gave maximum efficiency at Spider's present loading; when the auxiliary battery was dropped off speed could be increased by twenty-five percent to almost 250 klicks.

"Say something, Van!" said Warren Kingsley's amused voice from the world below.

"Leave me alone," Morgan replied equably. "I intend to relax and enjoy the view for the next couple of hours. If you wanted a running commentary, you should have sent Maxine Duval."

"She's been calling you for the last hour."

"Give her my love, and say I'm busy. Maybe when I reach the Tower. . . . What's the latest from there?"

"Temperature's stabilised at twenty - Monsoon Control zaps them with a modest megawattage every ten minutes. But Professor Sessui is furious - complains that it upsets his instruments."

"What about the air?"

"Not so good. The pressure has definitely dropped, and of course the CO2's building up. But they should be O.K. if you arrive on schedule. They're avoiding all unnecessary movement, to conserve oxygen."

All except Professor Sessui, I'll bet, thought Morgan. It would be interesting to meet the man whose life he was trying to save. He had read several of the scientist's widely-praised popular books, and considered them florid and overblown. Morgan suspected that the man matched the style.

"And the status at 10K?"

"Another two hours before the transporter can leave; they're installing some special circuits to make quite sure that nothing catches fire on this trip."

"A very good idea - Bartok's, I suppose."

"Probably. And they're coming down the north track, just in case the south one was damaged by the explosion. If all goes well, they'll arrive in - oh - twenty-one hours. Plenty of time, even if we don't send Spider up again with a second load."

Despite his only half-jesting remark to Kingsley, Morgan knew that it was far too early to start relaxing. Yet all did seem to be going as well as could be expected; and there was certainly nothing else that he could do for the next three hours except admire the ever-expanding view.

He was already thirty kilometres up in the sky, rising swiftly and silently through the tropical night. There was no moon, but the land beneath was revealed by the twinkling constellations of its towns and villages. When he looked at the stars above and the stars below, Morgan found it easy to imagine that he was far from any world, lost in the depths of space. Soon he could see the whole island of Taprobane, faintly outlined by the lights of the coastal settlements. Far to the north a dull glowing patch was creeping up over the horizon like the herald of some displaced dawn. It puzzled him for a moment, until he realised that he was looking at one of the great cities of Southern Hindustan.

He was higher now than any aircraft could climb, and what he had already done was unique in the history of transportation. Although Spider and its precursors had made innumerable trips up to twenty kilometres, no one had been allowed to go higher because of the impossibility of rescue. It had not been planned to commence serious operations until the base of the Tower was much closer, and Spider had at least two companions who could spin themselves up and down the other tapes of the system. Morgan pushed aside the thought of what could happen if the drive mechanism jammed; that would doom the refugees in the Basement, as well as himself.

Fifty kilometres; he had reached what would, in normal times, have been the lowest level of the ionosphere. He did not, of course, expect to see anything; but he was wrong.

The first intimation was a faint crackling from the capsule speaker; then, out of the corner of his eye, he saw a flicker of light. It was immediately below him, glimpsed in the downward-viewing mirror just outside Spider's little bay-window. He twisted the mirror around as far as it would adjust, until it was aimed at a point a couple of metres below the capsule. For a moment, he stared with astonishment, and more than a twinge of fear; then he called the Mountain.

"I've got company." he said. "I think this is in Professor Sessui's department. There's a ball of light - oh, about twenty centimetres across - running along the tape just below me. It's keeping at a constant distance, and I

hope it stays there. But I must say it's quite beautiful - a lovely bluish glow, flickering every few seconds. And I can hear it on the radio link."

It was a full minute before Kingsley answered in a reassuring tone of voice.

"Don't worry - it's only St. Elmo's Fire. We've had similar displays along the tape during thunderstorms; they can make your hair stand on end aboard the Mark I. But you won't feel anything - you're too well shielded."

"I'd no idea it could happen at this altitude."

"Neither did we. You'd better take it up with the Professor."

"Oh - it's fading out - getting bigger and fainter - now it's gone - I suppose the air's too thin for it - I'm sorry to see it go -"

"That's only a curtain raiser," said Kingsley. "Look what's happening directly above you."

A rectangular section of the star-field flashed by as Morgan tilted the mirror towards the zenith. At first he could see nothing unusual, so he switched off all the indicators on his control panel and waited in total darkness.

Slowly his eyes adapted, and in the depths of the mirror a faint red glow began to burn, and spread, and consume the stars. It grew brighter and brighter and flowed beyond the limits of the mirror; now he could see it directly, for it extended halfway down the sky. A cage of light, with flickering, moving bars, was descending upon the earth; and now Morgan could understand how a man like Professor Sessui could devote his life to unravelling its secrets.

On one of its rare visits to the equator, the aurora had come marching down from the Poles.

47. Beyond the Aurora

Morgan doubted if even Professor Sessui, five hundred kilometres above, had so spectacular a view. The storm was developing rapidly; short-wave radio - still used for many non-essential services - would by now have been disrupted all over the world. Morgan was not sure if he heard or felt a faint rustling, like the whisper of falling sand or the crackle of dry twigs. Unlike the static of the fireball, it certainly did not come from the speaker system, because it was still there when he switched off the circuit.

Curtains of pale green fire, edged with crimson, were being drawn across the sky, then shaken slowly back and forth as if by an invisible hand. They were trembling before the gusts of the solar wind, the million-kilometre-an-hour gale blowing from Sun to Earth - and far beyond. Even above Mars a feeble auroral ghost was flickering now; and sunward, the poisonous skies of Venus were ablaze. Above the pleated curtains long rays like the ribs of a half-opened fan were sweeping around the horizon; sometimes they shone straight into Morgan's eyes like the beams of a giant searchlight, leaving him dazzled for minutes. There was no need, any longer, to turn off the capsule illumination to prevent it from blinding him; the celestial fireworks outside were brilliant enough to read by.

Two hundred kilometres; Spider was still climbing silently, effortlessly. It was hard to believe that he had left earth exactly an hour ago. Hard, indeed, to believe that earth still existed; for he was now rising between the walls of a canyon of fire.

The illusion lasted only for seconds; then the momentary unstable balance between magnetic fields and incoming electric clouds was destroyed. But for that brief instant Morgan could truly believe that he was ascending out of a chasm that would dwarf even Valles Marineris - the Grand Canyon of Mars. Then the shining cliffs, at least a hundred kilometres high, became translucent and were pierced by stars. He could see them for what they really were - mere phantoms of fluorescence.

And now, like an airplane breaking through a ceiling of low-lying clouds, Spider was climbing above the display. Morgan was emerging from a fiery mist, twisting and turning beneath him. Many years ago he had been aboard a tourist liner cruising through the tropical night, and he remembered how he had joined the other passengers on the stern, entranced by the beauty and wonder of the bioluminescent wake. Some of the greens and blues flickering below him now matched the plankton-generated colours he had seen then, and he could easily imagine that he was again watching the byproducts of life - the play of giant, invisible beasts, denizens of the upper atmosphere. . .

He had almost forgotten his mission, and it was a distinct shock when he was recalled to duty.

"How's power holding up?" asked Kingsley "You've only another twenty minutes on that battery."

Morgan glanced at his instrument panel. "It's dropped to ninety-five percent - but my rate of climb has increased by five percent. I'm doing 220 klicks."

"That's about right, Spider's feeling the lower gravity - it's already down by ten percent at your altitude."

That was not enough to be noticeable, particularly if one was strapped in a seat and wearing several kilos of spacesuit. Yet Morgan felt positively buoyant, and he wondered if he was getting too much oxygen.

No, the flow-rate was normal. It must be the sheer exhilaration produced by that marvellous spectacle beneath him - though it was diminishing now, drawing back to north and south, as if retreating to its polar strongholds. That, and the satisfaction of a task well begun, using a technology that no man had ever before tested to such limits.

This explanation was perfectly reasonable, but he was not satisfied with it. It did not wholly account for his sense of happiness - even of joy. Warren Kingsley, who was fond of diving, had often told him that he felt such an emotion in the weightless environment of the sea. Morgan had never shared it, but now he knew what it must be like. He seemed to have left all his cares down there on the planet hidden below the fading loops and traceries of the aurora.

The stars were coming back into their own, no longer challenged by the eerie intruder from the poles. Morgan began to search the zenith, not with any high expectations, wondering if the Tower was yet in sight. But he could make out only the first few metres, still lit by the faint auroral glow, of the narrow

ribbon up which Spider was swiftly and smoothly climbing. That thin band upon which his own life - and seven others' - now depended was so uniform and featureless that it gave no hint of the capsule's speed; Morgan found it difficult to believe that it was flashing through the drive mechanism at more than two hundred kilometres an hour. And, with that thought, he was suddenly back in his childhood, and knew the source of his contentment.

He had quickly recovered from the loss of that first kite, and had graduated to larger and more elaborate models. Then, just before he had discovered Meccano and abandoned kites forever, he had experimented briefly with toy parachutes. Morgan liked to think that he had invented the idea himself, though he might well have come across it somewhere in his reading or viewing. The technique was so simple that generations of boys must have rediscovered it.

First he had whittled a thin strip of wood about five centimetres long, and fastened a couple of paper-clips on to it. Then he had hooked these around the kite-string, so that the little device could slide easily up and down. Next he had made a handkerchief-sized parachute of rice paper, with silk strings; a small square of cardboard served as payload. When he had fastened that square to the wooden strip by a rubber band - not too firmly - he was in business.

Blown by the wind, the little parachute would go sailing up the string, climbing the graceful catenary to the kite. Then Morgan would give a sharp tug, and the cardboard weight would slip out of the rubber band. The parachute would float away into the sky, while the wood-and-wire rider came swiftly back to his hand, in readiness for the next launch.

With what envy he had watched his flimsy creations drift effortlessly out to sea! Most of them fell back into the water before they had travelled even one kilometre, but sometimes a little parachute would still be bravely maintaining altitude when it vanished from sight. He liked to imagine that these lucky voyagers reached the enchanted islands of the Pacific; but though he had written his name and address on the cardboard squares he never received any reply.

Morgan could not help smiling at these long-forgotten memories, yet they explained so much. The dreams of childhood had been far surpassed by the reality of adult life; he had earned the right to his contentment.

"Coming up to three eighty," said Kingsley. "How is the power level?"

"Beginning to drop - down to eighty-five percent - the battery's starting to fade."

"Well, if it holds out for another twenty kilometres, it will have done its job. How do you feel?"

Morgan was tempted to answer with superlatives, but his natural caution dissuaded him. "I'm fine," he said. "If we could guarantee a display like this for all our passengers, we wouldn't be able to handle the crowds."

"Perhaps it could be arranged," laughed Kingsley. "We could ask Monsoon Control to dump a few barrels of electrons in the right places. Not their usual line of business, but they're good at improvising. . . . aren't they?"

Morgan chuckled, but did not answer. His eyes were fixed on the instrument panel, where both power and rate of climb were now visibly dropping. But this

was no cause for alarm; Spider had reached 385 kilometres out of the expected 400, and the booster battery still had some life in it.

At 390 kilometres Morgan started to cut back the rate of climb, until Spider crept more and more slowly upwards. Eventually the capsule was barely moving, and it finally came to rest just short of 405 kilometres.

"I'm dropping the battery," Morgan reported. "Mind your heads."

A good deal of thought had been given to recovering that heavy and expensive battery, but there had been no time to improvise a braking system that would let it slide safely back, like one of Morgan's kite-riders. And though a parachute had been available, it was feared that the shrouds might become entangled with the tape. Fortunately the impact area, just ten kilometres east of the earth terminus, lay in dense jungle. The wild life of Taprobane would have to take its chances, and Morgan was prepared to argue with the Department of Conservation later.

He turned the safety key and then pressed the red button that fired the explosive charges; Spider shook briefly as they detonated. Then he switched to the internal battery, slowly released the friction brakes, and again fed power into the drive motors.

The capsule started to climb on the last lap of its journey. But one glance at the instrument panel told Morgan that something was seriously wrong. Spider should have been rising at over two hundred klicks; it was doing less than one hundred, even at full power. No tests or calculations were necessary; Morgan's diagnosis was instant, for the figures spoke for themselves. Sick with frustration, he reported back to Earth.

"We're in trouble," he said. "The charges blew - but the battery never dropped. Something's still holding it on."

It was unnecessary, of course, to add that the mission must now be aborted. Everyone knew perfectly well that Spider could not possibly reach the base of the Tower carrying several hundred kilos of dead-weight.

48. Night at the Villa

Ambassador Rajasinghe needed little sleep these nights; it was as if a benevolent Nature was granting him the maximum use of his remaining years. And at a time like this, when the Taprobanean skies were blazing with their greatest wonder for centuries, who could have stayed abed?

How he wished that Paul Sarath was here to share the spectacle! He missed his old friend more than he would have thought possible; there was no-one who could annoy and stimulate him in the way that Paul had done - no-one with the same bond of shared experience stretching back to boyhood. Rajasinghe had never thought that he would outlive Paul, or would see the fantastic billion-ton stalactite of the Tower almost span the gulf between its orbital foundation and Taprobane, thirty-six thousand kilometres below. To the end Paul had been utterly opposed to the project; he had called it a Sword of Damocles, and had

never ceased to predict its eventual plunge to earth. Yet even Paul had admitted that the Tower had already produced some benefits.

For perhaps the first time in history, the rest of the world actually knew that Taprobane existed, and was discovering its ancient culture. Yakkagala, with its brooding presence and its sinister legends, had attracted special attention; as a result, Paul had been able to get support for some of his cherished projects. The enigmatic personality of Yakkagala's creator had already given rise to numerous books and videodramas, and the son-et-lumière display at the foot of the Rock was invariably sold out. Shortly before his death Paul had remarked wryly that a minor Kalidasa industry was in the making, and it was becoming more and more difficult to distinguish fiction from reality.

Soon after midnight, when it was obvious that the auroral display had passed its climax, Rajasinghe had been carried back into his bedroom. As he always did when he had said goodnight to his household staff, he relaxed with a glass of hot toddy and switched on the late news summary. The only item that really interested him was the progress that Morgan was making; by this time he should be approaching the base of the Tower.

The news editor had already starred the latest development; a line of continuously flashing type announced

MORGAN STUCK 200 KM SHORT OF GOAL

Rajasinghe's fingertips requested the details, and he was relieved to find that his first fears were groundless. Morgan was not stuck; he was unable to complete the journey. He could return to earth whenever he wished - but if he did Professor Sessui and his colleagues would certainly be doomed.

Directly above his head the silent drama was being played out at this very moment. Rajasinghe switched from text to video, but there was nothing new - indeed, the item now being screened in the news recap was Maxine Duval's ascent, years ago, in Spider's precursor.

"I can do better than that," muttered Rajasinghe, and switched to his beloved telescope.

For the first months after he had become bed-ridden he had been unable to use it. Then Morgan had paid one of his brief courtesy calls, analysed the situation, and swiftly prescribed the remedy. A week later, to Rajasinghe's surprise and pleasure, a small team of technicians had arrived at the Villa Yakkagala, and had modified the instrument for remote operation. Now he could lie comfortably in bed, and still explore the starry skies and the looming face of the Rock. He was deeply grateful to Morgan for the gesture; it had shown a side of the engineer's personality he had not suspected.

He was not sure what he could see, in the darkness of the night - but he knew exactly where to look, for he had long been watching the slow descent of the Tower. When the sun was at the correct angle, he could even glimpse the four guiding tapes converging into the zenith, a quartet of shining hair-lines scratched upon the sky.

He set the azimuth bearing on the telescope control, and swung the instrument around until it pointed above Sri Kanda. As he began to track slowly upwards, looking for any sign of the capsule, he wondered what the Maha Thero was thinking about this latest development. Though Rajasinghe had not spoken to the prelate - now well into his nineties - since the Order had moved to Lhasa, he gathered that the Potala had not provided the hoped-for accommodation. The huge palace was slowly falling into decay while the Dalai Lama's executors haggled with the Chinese Federal Government over the cost of maintenance. According to Rajasinghe's latest information, the Maha Thero was now negotiating with the Vatican - also in chronic financial difficulties, but at least still master of its own house.

All things were indeed impermanent, but it was not easy to discern any cyclic pattern. Perhaps the mathematical genius of Parakarma-Goldberg might be able to do so; the last time Rajasinghe had seen him, he was receiving a major scientific award for his contributions to meteorology. Rajasinghe would never have recognised him; he was clean-shaven and wearing a suit cut in the very latest neo-Napoleonic fashion. But now, it seemed, he had switched religions again. . . . The stars slid slowly down the big monitor screen at the end of the bed, as the telescope tilted up towards the Tower. But there was no sign of the capsule, though Rajasinghe was sure that it must now be in the field of view.

He was about to switch back to the regular news channel when, like an erupting nova, a star flashed out near the lower edge of the picture. For a moment Rajasinghe wondered if the capsule had exploded; then he saw that it was shining with a perfectly steady light. He centred the image and zoomed to maximum power.

Long ago he had seen a two-century-old video-documentary of the first aerial wars, and he suddenly remembered a sequence showing a night attack upon London. An enemy bomber had been caught in a cone of searchlights, and had hung like an incandescent mote in the sky. He was seeing the same phenomenon now, on a hundredfold greater scale; but this time all the resources on the ground were combined to help, not to destroy, the determined invader of the night.

49. A Bumpy Ride

Warren Kingsley's voice had regained its control; now it was merely dull and despairing.

"We're trying to stop that mechanic from shooting himself" he said. "But it's hard to blame him. He was interrupted by another rush job on the capsule, and simply forgot to remove the safety-strap."

So, as usual, it was human error. While the explosive links were being attached, the battery had been held in place by two metal bands. And only one of them had been removed.... Such things happened with monotonous regularity; sometimes they were merely annoying, sometimes they were disastrous, and the man responsible had to carry the guilt for the rest of his days. In any event, recrimination was pointless. The only thing that mattered now was what to do next.

Morgan adjusted the external viewing mirror to its maximum downward tilt, but it was impossible to see the cause of the trouble. Now that the auroral display had faded the lower part of the capsule was in total darkness, and he had no means of illuminating it. But that problem, at least, could be readily solved. If Monsoon Control could dump kilowatts of infra-red into the basement of the Tower, it could easily spare him a few visible photons.

"We can use our own searchlights," said Kingsley, when Morgan passed on his request.

"No good - they'll shine straight into my eyes, and I won't be able to see a thing. I want a light behind and above me - there must be somebody in the right position."

"I'll check," Kingsley answered, obviously glad to make some useful gesture. It seemed a long time before he called again; looking at his timer, Morgan was surprised to see that only three minutes had elapsed.

"Monsoon Control could manage it, but they'd have to retune and defocus - I think they're scared of frying you. But Kinte can light up immediately; they have a pseudo-white laser - and they're in the right position. Shall I tell them to go ahead?"

Morgan checked his bearings - let's see, Kinte would be very high in the west - that would be fine.

"I'm ready," he answered, and closed his eyes.

Almost instantly, the capsule exploded with light. Very cautiously, Morgan opened his eyes again. The beam was coming from high in the west, still dazzlingly brilliant despite its journey of almost forty thousand kilometres. It appeared to be pure white, but he knew that it was actually a blend of three sharply-tuned lines in the red, green and blue parts of the spectrum.

After a few seconds' adjustment of the mirror he managed to get a clear view of the offending strap, half a metre beneath his feet. The end that he could see was secured to the base of Spider by a large butterfly nut; all be had to do was to unscrew that, and the battery would drop off.

Morgan sat silently analysing the situation for so many minutes that Kingsley called him again. For the first time there was a trace of hope in his deputy's voice.

"We've been doing some calculations, Van.... What do you think of this idea?"

Morgan heard him out, then whistled softly. "You're certain of the safety margin?" he asked.

"Of course," answered Kingsley, sounding somewhat aggrieved; Morgan hardly blamed him, but he was not the one who would be risking his neck.

"Well - I'll give it a try. But only for one second, the first time."

"That won't be enough. Still, it's a good idea - you'll get the feel of it."

Gently Morgan released the friction brakes that were holding Spider motionless on the tape. Instantly he seemed to rise out of the seat, as weight vanished. He counted "One, TWO !" and engaged the brakes again.

Spider gave a jerk, and for a fraction of a second Morgan was pressed uncomfortably down into the seat. There was an ominous squeal from the braking mechanism, then the capsule was at rest again, apart from a slight torsional vibration that quickly died away.

"That was a bumpy ride," said Morgan. "But I'm still here - and so is that infernal battery."

"So I warned you. You'll have to try harder. Two seconds at least."

Morgan knew that he could not outguess Kingsley, with all the figures and computing power at his command, but he still felt the need for some reassuring mental arithmetic. Two seconds of free fall - say half a second to put on the brakes - allowing one ton for the mass of Spider. . . . The question was: which would go first - the strap retaining the battery, or the tape that was holding him here four hundred kilometres up in the sky? In the usual way it would be "no contest" in a trial between hyperfilament and ordinary steel. But if he applied the brakes too suddenly - or they seized owing to this maltreatment - both might snap. And then he and the battery would reach the earth at very nearly the same time.

"Two seconds it is," he told Kingsley. "Here we go."

This time the jerk was nerve-racking in its violence, and the torsional oscillations took much longer to die out. Morgan was certain that he would have felt - or heard - the breaking of the strap. He was not surprised when a glance in the mirror confirmed that the battery was still there.

Kingsley did not seem too worried. "It may take three or four tries," he said.

Morgan was tempted to retort: "Are you after my job?" but then thought better of it. Warren would be amused; other unknown listeners might not.

After the third fall - he felt he had dropped kilometres, but it was only about a hundred metres - even Kingsley's optimism started to fade. It was obvious that the trick was not going to work.

"I'd like to send my compliments to the people who made that safety strap," said Morgan wryly. "Now what do you suggest? A three-second drop before I slam on the brakes?"

He could almost see Warren shake his head. "Too big a risk. I'm not so much worried about the tape as the braking mechanism. It wasn't designed for this sort of thing."

"Well, it was a good try," Morgan answered. "But I'm not giving up yet. I'm damned if I'll be beaten by a simple butterfly nut, fifty centimetres in front of my nose. I'm going outside to get at it."

50. The Falling Fireflies

01 15 24

This is Friendship Seven. I'll try to describe what I'm in here. I am in a big mass of some very small particles that are brilliantly lit up like they're luminescent. . . . They're coming by the capsule, and they look like little stars. A whole shower of them coming by.

01 16 10

They're very slow; they're not going away from me more than maybe three or four miles an hour. .

01 19 38

Sunrise has just come up behind in the periscope, as I looked back out of the window, I had literally thousands of small, luminous particles swirling round the capsule.

(Commander John Glenn, Mercury "Friendship Seven", 1962 Feb. 20.)

With the old-style spacesuits, reaching that butterfly nut would have been completely out of the question. Even with the Flexisuit that Morgan was now wearing it might still be difficult - but at least he would make the attempt.

Very carefully, because more lives than his own now depended upon it, he rehearsed the sequence of events. He must check the suit, depressurise the capsule, and open the hatch - which, luckily, was almost full-length. Then he must release the safety belt, get down on his knees - if he could! - and reach for that butterfly nut. Everything depended upon its tightness. There were no tools of any kind aboard Spider, but Morgan was prepared to match his fingers - even in spacegloves - against the average small wrench.

He was just about to describe his plan of operations in case anyone on the ground could find a fatal flaw when he became aware of a certain mild discomfort. He could readily tolerate it for much longer, if necessary, but there was no point in taking chances. If he used the capsule's own plumbing, he would not have to bother with the awkward Diver's Friend incorporated in the suit.

When he had finished he turned the key of the Urine Dump - and was startled by a tiny explosion near the base of the capsule. Almost instantly, to his astonishment, a cloud of twinkling stars winked into existence, as if a microscopic galaxy had been suddenly created. Morgan had the illusion that, just for a fraction of a second, it hovered motionless outside the capsule; then it started to fall straight down, as swiftly as any stone dropped on earth. Within seconds it had dwindled to a point, and then was gone.

Nothing could have brought home more clearly the fact that he was still wholly a captive of the earth's gravitational field. He remembered how, in the very early days of orbital flight, the first astronauts were puzzled and then amused by the haloes of ice crystals that accompanied them around the planet; there had been some feeble jokes about the "Constellation Urion". That could not happen here; anything that he dropped, however fragile it might be, would crash straight back into the atmosphere. He must never forget that, despite his altitude, he was not an astronaut, revelling in the freedom of weightlessness. He was a man inside a building four hundred kilometres high, preparing to open the window and go out on to the ledge.

51. On the Porch

Though it was cold and uncomfortable on the summit, the crowd continued to grow. There was something hypnotic about that brilliant little star in the zenith, upon which the thoughts of the world, as well as the laser beam from Kinte, were now focused. As they arrived, all the visitors would head for the north tape, and stroke it in a shy, half-defiant manner as if to say: "I know this is silly, but makes me feel I'm in contact with Morgan". Then they would gather round the coffee dispenser and listen to the reports coming over the speaker system. There was nothing new from the refugees in the Tower; they were all sleeping - or trying to sleep - in an attempt to conserve oxygen. As Morgan was not yet overdue, they had not been informed of the hold-up; but within the next hour they would undoubtedly be calling Midway to find what had happened.

Maxine Duval had arrived at Sri Kanda just ten minutes too late to see Morgan. There was a time when such a near-miss would have made her very angry; now she merely shrugged her shoulders and reassured herself with the thought that she would be the first to grab the engineer on his return. Kingsley had not allowed her to speak to him, and she had accepted even this ruling with good grace. Yes, she was growing old. ..

For the last five minutes the only sound that had come from the capsule was a series of "Checks" as Morgan went through the suit routine with an expert up in Midway. That was now complete; everyone was waiting tensely for the crucial next step.

"Valving the air," said Morgan, his voice overlaid with a slight echo now that he had closed the visor of his helmet. "Capsule pressure zero. No problem with breathing." A thirty second pause; then: "Opening the front door - there it goes. Now releasing the seat-belt."

There was an unconscious stirring and murmuring among the watchers. In imagination, every one of them was up there in the capsule, aware of the void that had suddenly opened before him.

"Quick-release buckle operated. I'm stretching my legs. Not much head-room.

"Just getting the feel of the suit - quite flexible - now I'm going out on the porch - don't worry! - I've got the seat-belt wrapped around my left arm.

"Phew. Hard work, bending as much as this. But I can see that butterfly nut, underneath the porch grille. I'm working out how to reach it. ..

"On my knees now - not very comfortable - I've got it! Now to see if it will turn. . .

The listeners became rigid, silent - then, in unison, relaxed with virtually simultaneous sighs of relief.

"No problem! I can turn it easily. Two revs already - any moment now - just a bit more - I can feel it coming off - LOOK OUT DOWN BELOW!"

There was a burst of clapping and cheering; some people put their hands over their heads and cowered in mock terror. One or two, not fully understanding that the falling nut would not arrive for five minutes and would descend ten kilometres to the east, looked genuinely alarmed.

Only Warren Kingsley failed to share the rejoicing. "Don't cheer too soon," he said to Maxine. "We're not out of the woods yet."

The seconds dragged by. . . one minute. . . two minutes...

"It's no use," said Morgan at last, his voice thick with rage and frustration. "I can't budge the strap. The weight of the battery is holding it jammed in the threads. Those jolts we gave must have welded it to the bolt."

"Come back as quickly as you can," said Kingsley. "There's a new power-cell on the way, and we can manage a turn-around in less than an hour. So we can still get up to the Tower in-oh, say six hours. Barring any further accidents, of course."

Precisely, thought Morgan; and he would not care to take Spider up again without a thorough check of the much-abused braking mechanism. Nor would he trust himself to make a second trip; he was already feeling the strain of the last few hours, and fatigue would soon be slowing down his mind and body, just when he needed maximum efficiency from both.

He was back in the seat now, but the capsule was still open to space and he had not yet refastened the safety belt. To do so would be to admit defeat; and that had never been easy for Morgan.

The unwinking glare of the Kinte laser, coming from almost immediately above, still transfixed him with its pitiless light. He tried to focus his mind upon the problem, as sharply as that beam was focused upon him.

All that he needed was a metal cutter - a hacksaw, or a pair of shears - that could sever the retaining strap. Once again he cursed the fact that there was no tool-kit aboard Spider; even so, it would hardly have contained what he needed.

There were megawatt-hours of energy stored in Spider's own battery; could he use that in any way? He had a brief fantasy of establishing an arc and burning through the strap; but even if suitable heavy conductors were available - and of course they weren't - the main power supply was inaccessible from the control cab.

Warren and all the skilled brains gathered around him had failed to find any solution. He was on his own, physically and intellectually. It was, after all, the situation he had always preferred.

And then, just as he was about to reach out and close the capsule door, Morgan knew what he had to do. All the time the answer had been right by his finger-tips.

52. The Other Passenger

To Morgan, it seemed that a huge weight had lifted from his shoulders. He felt completely, irrationally confident. This time, surely, it had to work.

Nevertheless, he did not move from his seat until he had planned his actions in minute detail. And when Kingsley, sounding a little anxious, once again urged him to hurry back, he gave an evasive answer. He did not wish to raise any false hopes-on earth, or in the Tower.

"I'm trying an experiment," be said. "Leave me alone for a few minutes."

He picked up the fibre dispenser that he had used for so many demonstrations - the little spinnerette that, years ago, had allowed him to descend the face of Yakkagala. One change had been made for reasons of safety; the first metre of filament had been coated with a layer of plastic, so that it was no longer quite invisible, and could be handled cautiously, even with bare fingers.

As Morgan looked at the little box in his hand, he realised how much he had come to regard it as a talisman - almost a good luck charm. Of course, he did not really believe in such things; he always had a perfectly logical reason for carrying the spinnerette around with him. On this ascent it had occurred to him that it might be useful because of its strength and unique lifting power. He had almost forgotten that it had other abilities as well. ..

Once more he clambered out of the seat, and knelt down on the metal grille of Spider's tiny porch to examine the cause of all the trouble. The offending bolt was only ten centimetres on the other side of the grid, and although its bars were too close together for him to put his hand through them, he had already proved that he could reach around it without too much difficulty.

He released the first metre of coated fibre, and, using the ring at the end as a plumb-bob, lowered it down through the grille. Tucking the dispenser itself firmly in a corner of the capsule, so that he could not accidentally knock it overboard, he then reached round the grille until he could grab the swinging weight. This was not as easy as he had expected, because even this remarkable spacesuit would not allow his arm to bend quite freely, and the ring eluded his grasps as it pendulumed back and forth.

After half-a-dozen attempts - tiring rather than annoying, because he knew that he would succeed sooner or later - he had looped the fibre around the shank of the bolt, just behind the strap it was still holding in place. Now for the really tricky part.

He released just enough filament from the spinnerette for the naked fibre to reach the bolt, and to pass around it; then he drew both ends tight - until he felt the loop catch in the thread. Morgan had never attempted this trick with a rod of tempered steel more than a centimetre thick, and had no idea how long it

would take. Bracing himself against the porch, he began to operate his invisible saw.

After five minutes he was sweating badly, and could not tell if he had made any progress at all. He was afraid to slacken the tension, lest the fibre should escape from the equally invisible slot it was - he hoped - slicing through the bolt. Several times Warren had called him, sounding more and more alarmed, and he had given a brief reassurance. Soon he would rest for a while, recover his breath - and explain what he was trying to do. This was the least that he owed to his anxious friends.

"Van," said Kingsley, "just what are you up to? The people in the, Tower have been calling - what shall I say to them?"

"Give me another few minutes - I'm trying to cut the bolt -"

The calm but authoritative woman's voice that interrupted Morgan gave him such a shock that he almost let go of the precious fibre. The words were muffled by his suit, but that did not matter. He knew them all too well, though it had been months since he had last heard them.

"Dr. Morgan," said CORA, "please lie down and relax for the next ten minutes."

"Would you settle for five?" he pleaded. "I'm rather busy at the moment."

CORA did not deign to reply; although there were units that could conduct simple conversations, this model was not among them.

Morgan kept his promise, breathing deeply and steadily for a full five minutes. Then he started sawing again. Back and forth, back and forth he worked the filament, as he crouched over the grille and the four-hundred-kilometre distant earth. He could feel considerable resistance, so he must be making some progress through that stubborn steel. But just how much there was no way of telling.

"Dr. Morgan," said CORA, "you really must lie down for half-an-hour."

Morgan swore softly to himself.

"You're making a mistake, young lady," he retorted. "I'm feeling fine." But he was lying; CORA knew about the ache in his chest. ..

"Who the hell are you talking to, Van?" asked Kingsley.

"Just a passing angel," answered Morgan. "Sorry I forgot to switch off the mike. I'm going to take another rest."

"What progress are you making?"

"Can't say. But I'm sure the cut's pretty deep by this time. It must be. . .

He wished that he could switch off CORA, but that of course was impossible, even if she had not been out of reach between his breastbone and the fabric of his spacesuit. A heart monitor that could be silenced was worse than useless - it was dangerous.

"Dr. Morgan," said CORA, now distinctly annoyed, "I really must insist. At least half-an-hour's complete rest."

This time Morgan did not feel like answering. He knew that CORA was right; but she could not be expected to understand that his was not the only life involved. And he was also sure that - like one of his bridges - she had a built-in safety factor. Her diagnosis would be pessimistic; his condition would not be as serious as she was pretending. Or so he devoutly hoped.

The pain in his chest certainly seemed to be getting no worse; he decided to ignore both it and CORA, and started to saw away, slowly but steadily, with the loop of fibre. He would keep going, he told himself grimly, just as long as was necessary.

The warning he had relied upon never came. Spider lurched violently as a quarter-ton of dead-weight ripped away, and Morgan was almost pitched out into the abyss. He dropped the spinnerette, and grabbed for the safety belt.

Everything seemed to happen in dreamlike slow motion. He had no sense of fear, only an utter determination not to surrender to gravity without a fight. But he could not find the safety belt; it must have swung back into the cabin.

He was not even conscious of using his left hand, but suddenly he realised that it was clamped around the hinges of the open door. Yet still he did not pull himself back into the cabin; he was hypnotised by the sight of the falling battery, slowly rotating like some strange celestial body as it dwindled from sight. It took a long time to vanish completely; and not until then did Morgan drag himself to safety, and collapse into his seat.

For a long time he sat there, his heart hammering, awaiting CORA's next indignant protest. To his surprise, she was silent, almost as if she too had been equally startled. Well, he would give her no further cause for complaint; from now on he would sit quietly at the controls, trying to relax his jangled nerves.

When he was himself again, he called the mountain.

"I've got rid of the battery," he said, and heard the cheers float up from earth. "As soon as I've closed the hatch I'll be on my way again. Tell Sessui and Co to expect me in just over an hour. And thank Kinte for the light - I don't need it now."

He repressurised the cabin, opened the helmet of his suit, and treated himself to a long, cold sip of fortified orange juice. Then he engaged drive and released the brakes, and lay back with a sense of overwhelming relief as Spider came up to full speed.

He had been climbing for several minutes before he realised what was missing. In anxious hope he peered out at the metal grille of the porch. No, it was not there. Well, he could always get another spinnerette, to replace the one now following the discarded battery back to earth; it was a small sacrifice for such an achievement. Strange, therefore, that he was so upset, and unable fully to enjoy his triumph... He felt that he had lost an old and faithful friend.

53. Fade Out

The fact that he was still only thirty minutes behind schedule seemed too good to be true; Morgan would have been prepared to swear that the capsule had halted for at least an hour. Up there in the Tower, now much less than two hundred kilometres away, the reception committee would be preparing to welcome him. He refused even to consider the possibility of any further problems.

When he passed the five-hundred-kilometre mark, still going strong, there was a message of congratulations from the ground. "By the way," added Kingsley, "the Game Warden in the Ruhana Sanctuary's reported an aircraft crashing. We were able to reassure him - if we can find the hole, we may have a souvenir for you." Morgan had no difficulty in restraining his enthusiasm; he was glad to see the last of that battery. Now if they could find the spinnerette - but that would be a hopeless task...

The first sign of trouble came at five-fifty kilometres. By now the rate of ascent should have been over two hundred klicks; it was only one nine eight. Slight though the discrepancy was - and it would make no appreciable difference to his arrival time - it worried Morgan.

When he was only thirty kilometres from the Tower he had diagnosed the problem, and knew that this time there was absolutely nothing he could do about it. Although there should have been ample reserve, the battery was beginning to fade. Perhaps those sudden jolts and restarts had brought on the malaise; possibly there was even some physical damage to the delicate components. Whatever the explanation the current was slowly dropping, and with it the capsule's speed.

There was consternation when Morgan reported the indicator readings back to the ground.

"I'm afraid you're right," Kingsley lamented, sounding almost in tears. "We suggest you cut speed back to one hundred klicks. We'll try to calculate battery life - though it can only be an educated guess."

Twenty-five kilometres to go - a mere fifteen minutes, even at this reduced speed! If Morgan had been able to pray, he would have done so.

"We estimate you have between ten and twenty minutes, judging by the rate the current is dropping. It will be a close thing, I'm afraid."

"Shall I reduce speed again?"

"Not for the moment; we're trying to optimise your discharge rate, and this seems about right."

"Well, you can switch on your beam now. If I can't get to the Tower, at least I want to see it."

Neither Kinte nor the other orbiting stations could help him, now that he wished to look up at the underside of the Tower. This was a task for the searchlight on Sri Kanda itself, pointing vertically towards the zenith.

A moment later the capsule was impaled by a dazzling beam from the heart of Taprobane. Only a few metres away - indeed, so close that he felt he could touch

them - the other three guiding tapes were ribbons of light, converging towards the Tower. He followed their dwindling perspective - and there it was.

Just twenty kilometres away! He should be there in a dozen minutes, coming up through the floor of that tiny square building he could see glittering in the sky, bearing presents like some troglodytic Father Christmas. Despite his determination to relax, and obey CORA's orders, it was quite impossible to do so. He found himself tensing his muscles, as if by his own physical exertions he could help Spider along the last fraction of its journey.

At ten kilometres there was a distinct change of pitch from the drive motor; Morgan had been expecting this, and reacted to it at once. Without waiting for advice from the ground, he cut speed back to fifty klicks. At this rate he still had twelve minutes to go, and he began to wonder despairingly if he was involved in an asymptotic approach. This was a variant of the race between Achilles and the tortoise; if he halved his speed every time he halved the distance, would he reach the Tower in a finite time? Once he would have known the answer instantly; now he felt too tired to work it out.

At five kilometres he could see the constructional details of the Tower - the catwalk and protective rails, the futile safety net provided as a sop to public opinion. Although he strained his eyes he could not yet make out the airlock towards which he was now crawling with such agonising slowness.

And then it no longer mattered. Two kilometres short of the goal Spider's motors stalled completely. The capsule even slid downwards a few metres, before Morgan was able to apply the brakes.

Yet this time, to Morgan's surprise, Kingsley did not seem utterly downcast.

"You can still make it," he said. "Give the battery ten minutes to recuperate. There's still enough energy there for that last couple of kilometres."

It was one of the longest ten minutes that Morgan had ever known. Though he could have made it pass more swiftly by responding to Maxine Duval's increasingly desperate pleas, he felt too emotionally exhausted to talk. He was genuinely sorry about this, and hoped that Maxine would understand and forgive him.

He did have one brief exchange with Driver-Pilot Chang, who reported that the refugees in the Basement were still in fairly good shape, and much encouraged by his nearness. They were taking turns to peer at him through the one small porthole of the airlock's outer door, and simply could not believe that he might never be able to bridge the trifling space between them.

Morgan gave the battery an extra minute for luck. To his relief the motors responded strongly, with an encouraging surge of power. Spider got within half a kilometre of the Tower before stalling again.

"Next time does it," said Kingsley, though it seemed to Morgan that his friend's confidence now sounded somewhat forced. "Sorry for all these delays. . .

"Another ten minutes?" Morgan asked with resignation.

"I'm afraid so. And this time use thirty-second bursts, with a minute between them. That way, you'll get the last erg out of the battery."

And out of me, thought Morgan. Strange that CORA had been quiet for so long. Still, this time be had not exerted himself physically; it only felt that way.

In his preoccupation with Spider he had been neglecting himself. For the last hour he had quite forgotten his zero-residue glucose-based energy tablets and the little plastic bulb of fruit juice. After he had sampled both he felt much better, and only wished that he could transfer some of the surplus calories to the dying battery.

Now for the moment of truth - the final exertion. Failure was unthinkable, when he was so close to the goal. The fates could not possibly be so malevolent, now that he had only a few hundred metres to go. ..

He was whistling in the dark, of course. How many aircraft had crashed at the very edge of the runway, after safely crossing an ocean? How many times had machines or muscles failed, when there were only millimetres to go? Every possible piece of luck, bad as well as good, happened to somebody, somewhere. He had no right to expect any special treatment.

The capsule heaved itself upwards in fits and starts, like a dying animal seeking its last haven. When the battery finally expired, the base of the Tower seemed to fill half the sky.

But it was still twenty metres above him.

54. Theory of Relativity

It was to Morgan's credit that he felt his own fate was sealed, in the desolating moment when the last dregs of power were exhausted, and the lights on Spider's display panel finally faded out. Not for several seconds did he remember that he had only to release the brakes and he would slide back to Earth. In three hours he could be safely back in bed. No-one would blame him for the failure of his mission; he had done all that was humanly possible.

For a brief while he stared in a kind of dull fury at that inaccessible square, with the shadow of Spider projected upon it. His mind revolved a host of crazy schemes, and rejected them all. If he still had his faithful little spinnerette - but there would have been no way of getting it to the Tower. If the refugees had possessed a spacesuit, someone could have lowered a rope to him - but there had been no time to collect a suit from the burning transporter.

Of course, if this was a videodrama, and not a real-life problem, some heroic volunteer could sacrifice himself - better still, herself - by going into the lock and tossing down a rope, using the fifteen seconds of vacuum consciousness to save the others. It was some measure of Morgan's desperation that, for a fleeting moment, he even considered this idea before commonsense reasserted itself.

From the time that Spider had given up the battle with gravity, until Morgan finally accepted that there was nothing more that he could do, probably less

than a minute had elapsed. Then Warren Kingsley asked a question which, at such a moment, seemed an annoying irrelevance.

"Give us your distance again, Van - exactly how far are you from the Tower?"

"What the hell does it matter? It could be a light-year."

There was a brief silence from the ground; then Kingsley spoke again, in the sort of tone one uses to address a small child or a difficult invalid. "It makes all the difference in the world. Did you say twenty metres?"

"Yes - that's about it."

Incredibly - unmistakeably - Warren gave a clearly audible sigh of relief. There was even joy in his voice when he answered: "And all these years, Van, I thought that you were the Chief Engineer on this project. Suppose it is twenty metres exactly -"

Morgan's explosive shout prevented him from finishing the sentence. "What an idiot! Tell Sessui I'll dock in - oh, fifteen minutes."

"Fourteen point fIve, if you've guessed the distance right. And nothing on earth can stop you now."

That was still a risky statement, and Morgan wished that Kingsley hadn't made it. Docking adaptors sometimes failed to latch together properly, because of minute errors in manufacturing tolerances. And, of course, there had never been a chance of testing this particular system.

He felt only a slight embarrassment at his mental blackout. After all, under extreme stress a man could forget his own telephone number, even his own date of birth. And until this very moment the now dominant factor in the situation had been so unimportant that it could be completely ignored.

It was all a matter of Relativity. He could not reach the Tower; but the Tower would reach him - at its inexorable two kilometres a day.

55. Hard Dock

The record for one day's construction had been thirty kilometres, when the slimmest and lightest section of the Tower was being assembled. Now that the most massive portion - the very root of the structure - was nearing completion in orbit, the rate was down to two kilometres. That was quite fast enough; it would give Morgan time to check the adaptor line-up, and to mentally rehearse the rather tricky few seconds between confirming hard-dock and releasing Spider's brakes. If he left them on for too long there would be a very unequal trial of strength between the capsule and the moving megatons of the Tower.

It was a long but relaxed fifteen minutes - time enough, Morgan hoped, to pacify CORA. Towards the end everything seemed to happen very quickly, and at the last moment he felt like an ant about to be crushed in a stamping press, as the solid roof of the sky descended upon him. One second the base of the Tower

was still metres away; an instant later he felt and heard the impact of the docking mechanism.

Many lives depended now upon the skill and care with which the engineers and mechanics, years ago, had done their work. If the couplings did not line up within the allowed tolerances; if the latching mechanism did not operate correctly; if the seal was not airtight. . . . Morgan tried to interpret the medley of sounds reaching his ears, but he was not skilled enough to read their messages.

Then, like a signal of victory, the DOCKING COMPLETED sign flashed on the indicator board. There would be ten seconds while the telescopic elements could still absorb the movement of the advancing Tower; Morgan used half of them before he cautiously released the brakes. He was prepared to jam them on again instantly if Spider started to drop - but the sensors were telling the truth. Tower and capsule were now firmly mated together. Morgan had only to climb a few rungs of ladder, and he would have reached his goal.

After he had reported to the jubilant listeners on Earth and Midway, he sat for a moment recovering his breath. Strange to think that this was his second visit, but he could remember little of that first one, twelve years ago and thirty-six thousand kilometres away. During what had, for want of a better term, been called the foundation laying, there had been a small party in the Basement, and numerous zero-gee toasts had been squirted. For this was not only the very first section of the Tower to be built; it would also be the first to make contact with Earth, at the end of its long descent from orbit. Some kind of ceremony therefore seemed in order, and Morgan now recalled that even his old enemy, Senator Collins, had been gracious enough to attend and to wish him luck with a barbed but good-humoured speech. There was even better cause for celebration now.

Already Morgan could hear a faint tattoo of welcoming raps from the far side of the airlock. He undid his safety belt, climbed awkwardly on to the seat, and started to ascend the ladder. The overhead hatch gave a token resistance, as if the powers marshalled against him were making one last feeble gesture, and air hissed briefly while pressure was equalised. Then the circular plate swung open and downwards, and eager hands helped him up into the Tower. As Morgan took his first breath of the fetid air he wondered how anyone could have survived here; if his mission had been aborted, he felt quite certain that a second attempt would have been too late.

The bare, bleak cell was lit only by the solar-fluorescent panels which had been patiently trapping and releasing sunlight for more than a decade, against the emergency that had arrived at last. Their illumination revealed a scene that might have come from some old war; here were homeless and dishevelled refugees from a devastated city, huddling in a bomb shelter with the few possessions they had been able to save. Not many such refugees, however, would have carried bags labelled PROJECTION, LUNAR HOTEL CORPORATION, PROPERTY OF THE FEDERAL REPUBLIC OF MARS, or the ubiquitous MAY/NOT/BE STOWED IN VACUUM. Nor would they have been so cheerful; even those who were lying down to conserve oxygen managed a smile and a languid wave. Morgan had just returned the salute when his legs buckled beneath him, and everything blacked out. Never before in his life had he fainted, and when the blast of cold oxygen revived him his first emotion was one of acute embarrassment. His eyes came slowly into focus, and be saw masked shapes hovering over him. For a moment he wondered if he was in hospital; then brain and vision returned to normal. While he was still unconscious, his precious cargo must have been unloaded.

Those masks were the molecular sieves he had carried up to the Tower; worn over nose and mouth, they would block the CO2 but allow oxygen to pass. Simple yet technologically sophisticated, they would enable men to survive in an atmosphere which would otherwise cause instant suffocation. It required a little extra effort to breathe through them, but Nature never gives something for nothing - and this was a very small price to pay.

Rather groggily, but refusing any help, Morgan got to his feet and was belatedly introduced to the men and women he had saved. One matter still worried him: while he was unconscious, had CORA delivered any of her set speeches? He did not wish to raise the subject, but he wondered.

"On behalf of all of us," said Professor Sessui, with sincerity yet with the obvious awkwardness of a man who was seldom polite to anyone, "I want to thank you for what you've done. We owe our lives to you."

Any logical or coherent reply to this would have smacked of false modesty, so Morgan used the excuse of adjusting his mask to mumble something unintelligible. He was about to start checking that all the equipment had been unloaded when Professor Sessui added, rather anxiously; "I'm sorry we can't offer you a chair - this is the best we can do." He pointed to a couple of instrument boxes, one on top of the other. "You really should take it easy."

The phrase was familiar; so CORA had spoken. There was a slightly embarrassed pause while Morgan registered this fact, and the others admitted that they knew, and he showed that he knew they knew - all without a word being uttered, in the kind of psychological infinite regress that occurs when a group of people share completely a secret which nobody will ever mention again.

He took a few deep breaths - it was amazing how quickly one got used to the masks - and then sat down on the proffered seat. I'm not going to faint again, he told himself with grim determination. I must deliver the goods, and get out of here as quickly as possible - hopefully, before there are any more pronouncements from CORA.

"That can of sealant," he said, pointing to the smallest of the containers he had brought, "should take care of your leak. Spray it round the gasket of the airlock; it sets hard in a few seconds. Use the oxygen only when you have to; you may need it to sleep. There's a CO2 mask for everyone, and a couple of spares. And here's food and water for three days - that should be plenty. The transporter from 10K should be here tomorrow. As for the Medikit - I hope you won't need that at all."

He paused for breath; it was not easy to talk while wearing a CO2 filter, and he felt an increasing need to conserve his strength. Sessui's people could now take care of themselves, but he still had one further job to do - and the sooner the better.

Morgan turned to Driver Chang and said quietly: "Please help me to suit up again. I want to inspect the track."

"That's only a thirty-minute suit you're wearing!"

"I'll need ten minutes - fifteen at the most."

"Dr. Morgan - I'm a space-qualified operator - you're not. No-one's allowed to go out in a thirty-minute suit without a spare pack, or an umbilical. Except in an emergency, of course."

Morgan gave a tired smile. Chang was right, and the excuse of immediate danger no longer applied. But an emergency was whatever the Chief Engineer said it was.

"I want to look at the damage," he answered, "and examine the tracks. It would be a pity if the people from 10K can't reach you, because they weren't warned of some obstacle."

Chang was clearly not too happy about the situation (what had that gossiping CORA jabbered while he was unconscious?), but raised no further arguments as he followed Morgan into the north lock.

Just before he closed the visor Morgan asked, "Any more trouble with the Professor?"

Chang shook his head. "I think the CO2 has slowed him down. And if he starts up again - well, we outnumber him six to one, though I'm not sure if we can count on his students. Some of them are just as crazy as he is; look at that girl who spends all her time scribbling in the corner. She's convinced that the sun's going out, or blowing up - I'm not sure which - and wants to warn the world before she dies. Much good that would do. I'd prefer not to know."

Though Morgan could not help smiling, he felt quite sure that none of the professor's students would be crazy. Eccentric, perhaps - but also brilliant; they would not be working with Sessui otherwise. One day he must find out more about the men and women whose lives he had saved; but that would have to wait until they had all returned to earth, by their separate ways.

"I'm going to take a quick walk around the Tower," said Morgan, "and I'll describe any damage so that you can report to Midway. It won't take more than ten minutes. And if it does - well, don't try to get me back."

Driver Chang's reply, as he closed the inner door of the airlock, was very practical and very brief. "How the hell could I?" he asked.

56. View from the Balcony

The outer door of the north airlock opened without difficulty, framing a rectangle of complete darkness. Running horizontally across that darkness was a line of fire - the protective hand-rail of the catwalk, blazing in the beam of the searchlight pointed straight up from the mountain so far below. Morgan took a deep breath and flexed the suit. He felt perfectly comfortable, and waved to Chang, peering at him through the window of the inner door. Then he stepped out of the Tower.

The catwalk that surrounded the Basement was a metal grille about two metres wide; beyond it the safety net had been stretched out for another thirty metres. The portion that Morgan could see had caught nothing whatsoever during its years of patient waiting.

He started his circumnavigation of the Tower, shielding his eyes against the glare blasting up from underfoot. The oblique lighting showed up every least bump and imperfection in the surface that stretched above him like a roadway to the stars - which, in a sense, it was.

As he had hoped and expected, the explosion on the far side of the Tower had caused no damage here; that would have required an atomic bomb, not a mere electro-chemical one. The twin grooves of the track, now awaiting their first arrival, stretched endlessly upwards in their pristine perfection. And fifty metres below the balcony - though it was hard to look in that direction because of the glare - he could just make out the terminal buffers, ready for a task which they should never have to perform.

Taking his time, and keeping close to the sheer face of the Tower, Morgan walked slowly westwards until he came to the first corner. As he turned he looked back at the open door of the airlock, and the - relative, indeed! - safety that it represented. Then he continued boldly along the blank wall of the west face.

He felt a curious mixture of elation and fear, such as he had not known since he had learned to swim and found himself for the first time, in water out of his depth. Although he was certain that there was no real danger, there could be. He was acutely aware of CORA, biding her time; but Morgan bad always hated to leave any job undone, and his mission was not yet complete.

The west face was exactly like the north one, except for the absence of an airlock. Again, there was no sign of damage, even though it was closer to the scene of the explosion.

Checking the impulse to hurry - after all, he had been outside for only three minutes - Morgan strolled on to the next corner. Even before he turned it, he could see that he was not going to complete his planned circuit of the Tower. The catwalk had been ripped off and was dangling out into space, a twisted tongue of metal. The safety net had vanished altogether, doubtless torn away by the falling transporter.

I won't press my luck, Morgan told himself. But he could not resist peering round the corner, holding on to the section of the guard rail that still remained.

There was a good deal of debris stuck in the track, and the face of the Tower had been discoloured by the explosion. But, as far as Morgan could see, even here there was nothing that could not be put right in a couple of hours by a few men with cutting torches. He gave a careful description to Chang, who expressed relief and urged Morgan to get back into the Tower as soon as possible.

"Don't worry," said Morgan. "I've still got ten minutes and all of thirty metres to go. I could manage on the air I have in my lungs now."

But he did not intend to put it to the test. He had already had quite enough excitement for one night. More than enough, if CORA was to be believed; from now on he would obey her orders implicitly.

When he had walked back to the open door of the airlock he stood for a few final moments beside the guard-rail, drenched by the fountain of light leaping

up from the summit of Sri Kanda far below. It threw his own immensely elongated shadow directly along the Tower, vertically upwards towards the stars. That shadow must stretch for thousands of kilometres, and it occurred to Morgan that it might even reach the transporter now dropping swiftly down from the 10K Station. If he waved his arms the rescuers might be able to see his signals; he could talk to them in Morse code.

This amusing fantasy inspired a more serious thought. Would it be best for him to wait here, with the others, and not risk the return to earth in Spider? But the journey up to Midway, where he could get good medical attention, would take a week. That was not a sensible alternative, since he could be back on Sri Kanda in less than three hours.

Time to go inside - his air must be getting low and there was nothing more to see. That was a disappointing irony, considering the spectacular view one would normally have here, by day or by night. Now, however, the planet below and the heavens above were both banished by the blinding glare from Sri Kanda; he was floating in a tiny universe of light, surrounded by utter darkness on every side. It was almost impossible to believe that he was in space, if only because of his sense of weight. He felt as secure as if he were standing on the mountain itself, instead of six hundred kilometres above it. That was a thought to savour, and to carry back to earth.

He patted the smooth, unyielding surface of the Tower, more enormous in comparison to him than an elephant to an amoeba. But no amoeba could ever conceive of an elephant - still less create one.

"See you on earth in a year's time," Morgan whispered, and slowly closed the airlock door behind him.

57. The Last Dawn

Morgan was back in the Basement for only five minutes; this was no time for social amenities, and he did not wish to consume any of the precious oxygen he had brought here with such difficulty. He shook hands all round, and scrambled back into Spider.

It was good to breathe again without a mask - better still to know that his mission had been a complete success, and that in less than three hours he would be safely back on Earth. Yet, after all the effort that had gone into reaching the Tower, he was reluctant to cast off again, and to surrender once more to the pull of gravity - even though it was now taking him home. But presently he released the docking latches and started to fall downwards, becoming weightless for several seconds.

When the speed indicator reached three hundred klicks, the automatic braking system came on and weight returned. The brutally depleted battery would be recharging now, but it must have been damaged beyond repair and would have to be taken out of service.

There was an ominous parallel here: Morgan could not help thinking of his own overstrained body, but a stubborn pride still kept him from asking for a

doctor on stand-by. He had made a little bet with himself; he would do so only if CORA spoke again.

She was silent now, as he dropped swiftly through the night. Morgan felt totally relaxed, and left Spider to look after itself while he admired the heavens. Few spacecraft provided so panoramic a view, and not many men could ever have seen the stars under such superb conditions. The aurora had vanished completely, the searchlight had been extinguished, and there was nothing left to challenge the constellations.

Except, of course, the stars that man himself had made. Almost directly overhead was the dazzling beacon of Ashoka, poised forever above Hindustan - and only a few hundred kilometres from the Tower complex. Halfway down in the east was Confucius, much lower still Kamehameha, while high up from the west shone Kinte and Imhotep. These were merely the brightest signposts along the equator; there were literally scores of others, all of them far more brilliant than Sirius. How astonished one of the old astronomers would have been to see this necklace around the sky; and how bewildered he would have become when, after an hour or so's observation, he discovered that they were quite immobile - neither rising nor setting while the familiar stars drifted past in their ancient courses.

As he stared at the diamond necklace stretched across the sky, Morgan's sleepy mind slowly transformed it into something far more impressive. With only a slight effort of the imagination, those man-made stars became the lights of a titanic bridge.

He drifted into still wilder fantasies. What was the name of the bridge into Valhalla, across which the heroes of the Norse legends passed from this world to the next? He could not remember, but it was a glorious dream. And had other creatures, long before Man, tried in vain to span the skies of their own worlds? He thought of the splendid rings encircling Saturn, the ghostly arches of Uranus and Neptune. Although he knew perfectly well that none of these worlds had ever felt the touch of life, it amused him to think that here were the shattered fragments of bridges that had failed.

He wanted to sleep but, against his will, imagination had seized upon the idea. Like a dog that had just discovered a new bone, it would not let go. The concept was not absurd; it was not even original. Many of the synchronous stations were already kilometres in extent, or linked by cables which stretched along appreciable fractions of their orbit. To join them together, thus forming a ring completely around the world, would be an engineering task much simpler than the building of the Tower, and involving much less material.

No - not a ring - a wheel. This Tower was only the first spoke. There would be others (four? six? a score?) spaced along the equator. When they were all connected rigidly up there in orbit, the problems of stability that plagued a single tower would vanish. Africa - South America, the Gilbert Islands, Indonesia - they could all provide locations for earth terminals, if desired. For some day, as materials improved and knowledge advanced, the Towers could be made invulnerable even to the worst hurricanes, and mountain sites would no longer be necessary. If he had waited another hundred years, perhaps he need not have disturbed the Maha Thero.

While he was dreaming the thin crescent of the waning moon had lifted unobtrusively above the eastern horizon, already aglow with the first hint of dawn. Earthshine lit the entire lunar disc so brilliantly that Morgan could see

much of the nightland detail; he strained his eyes in the hope of glimpsing that loveliest of sights, never seen by earlier ages - a star within the arms of the crescent moon. But none of the cities of man's second home was visible tonight.

Only two hundred kilometers - less than an hour to go. There was no point in trying to keep awake; Spider had automatic terminal programming and would touch gently down without disturbing his sleep.

The pain woke him first; CORA was a fraction of a second later. "Don't try to move," she said soothingly. "I've radioed for help. The ambulance is on the way."

That was funny. But don't laugh, Morgan ordered himself, she's only doing her best. He felt no fear; though the pain beneath his breastbone was intense, it was not incapacitating. He tried to focus his mind upon it, and the very act of concentration relieved the symptoms. Long ago he had discovered that the best way of handling pain was to study it objectively.

Warren was calling him, but the words were far away and had little meaning. He could recognise the anxiety in his friend's voice, and wished that he could do something to alleviate it; but he had no strength left to deal with this problem - or with any other. Now he could not even hear the words; a faint but steady roar had obliterated all other sounds. Though he knew that it existed only in his mind - or the labyrinthine channels of his ears - it seemed completely real; he could believe that he was standing at the foot of some great waterfall. ..

It was growing fainter, softer - more musical. And suddenly he recognised it. How pleasant to hear once more, on the silent frontier of space, the sound he remembered from his very first visit to Yakkagala!

Gravity was drawing him home again, as through the centuries its invisible hand had shaped the trajectory of the Fountains of Paradise. But he had created something that gravity could never recapture, as long as men possessed the wisdom and the will to preserve it.

How cold his legs were! What had happened to Spider's life-support system? But soon it would be dawn; then there would be warmth enough.

The stars were fading, far more swiftly than they had any right to do. That was strange; though the day was almost here, everything around him was growing dark. And the fountains were sinking back into the earth, their voices becoming fainter fainter. . . fainter.

And now there was another voice, but Vannevar Morgan did not hear it. Between brief, piercing bleeps CORA cried to the approaching dawn:

HELP! WILL ANYONE WHO HEARS ME PLEASE COME AT ONCE!

THIS IS A CORA EMERGENCY!

HELP! WILL ANYONE WHO HEARS ME PLEASE COME AT ONCE!

She was still calling when the sun came up, and its first rays caressed the summit of mountain that had once been sacred. Far below the shadow of Sri Kanda leaped forth upon the clouds, its perfect cone still unblemished, despite all that man had done.

There were no pilgrims now, to watch that symbol of eternity lie across the face of the awakening land. But millions would see it, in the centuries ahead, as they rode in comfort and safety to the stars.

58. Epilogue: Kalidasa's Triumph

In the last days of that last brief summer, before the jaws of ice clenched shut around the equator, one of the Starholme envoys came to Yakkagala.

A Master of the Swarms, It had recently conjugated Itself into human form. Apart from one minor detail, the likeness was excellent; but the dozen children who had accompanied the Holmer in the autocopter were in a constant state of mild hysteria - the younger ones frequently dissolving into giggles.

"What's so funny?" It had asked in Its perfect Solar. "Or is this a private joke?"

But they would not explain to the Starholmer, whose normal colour vision lay entirely in the infra-red, that the human skin was not a random mosaic of greens and reds and blues. Even when It had threatened to turn into a Tyrannosaurus Rex and eat them all up, they still refused to satisfy Its curiosity. Indeed, they quickly pointed out - to an entity that had crossed scores of light-years and collected knowledge for thirty centuries - that a mass of only a hundred kilogrammes would scarcely make an impressive dinosaur.

The Holmer did not mind; It was patient, and the children of Earth were endlessly fascinating, in both their biology and their psychology. So were the young of all creatures - all, of course, that did have young. Having studied nine such species, the Holmer could now almost imagine what it must be like to grow up, mature, and die. . . almost, but not quite.

Spread out before the dozen humans and one non-human lay the empty land, its once luxuriant fields and forests blasted by the cold breaths from north and south. The graceful coconut palms had long since vanished, and even the gloomy pines that had succeeded them were naked skeletons, their roots destroyed by the spreading permafrost. No life was left upon the surface of the Earth; only in the oceanic abyss, where the planet's internal heat kept the ice at bay, did a few blind, starveling creatures crawl and swim and devour each other.

Yet to a being whose home had circled a faint red star, the sun that blazed down from the cloudless sky still seemed intolerably bright. Though all its warmth had gone, drained away by the sickness that had attacked its core a thousand years ago, its fierce, cold light revealed every detail of the stricken land, and flashed in splendour from the approaching glaciers.

For the children, still revelling in the powers of their awakening minds, the sub-zero temperatures were an exciting challenge. As they danced naked through the snowdrifts, bare feet kicking up clouds of powder-dry, shining

crystals, their symbiotes often had to warn them: "Don't over-ride your frost-bite signals!" For they were not yet old enough to replicate new limbs without the help of their elders.

The oldest of the boys was showing off; he had launched a deliberate assault on the cold, announcing proudly that he was a fire-elemental. (The Starholmer noted the term for future research, which would later cause It much perplexity.) All that could be seen of the small exhibitionist was a column of flame and steam, dancing to and fro along the ancient brickwork; the other children pointedly ignored this rather crude display.

To the Starholmer, however, it presented an interesting paradox. Just why had these people retreated to the inner planets, when they could have fought back the cold with the powers that they now possessed - as, indeed, their cousins were doing on Mars? That was a question to which It had still not received a satisfactory answer. It considered again the enigmatic reply It had been given by ARISTOTLE, the entity with which It most easily communicated.

"For everything there is a season," the global brain had replied. "There is a time to battle against Nature, and a time to obey her. True wisdom lies in making the right choice. When the long winter is over, Man will return to an Earth renewed and refreshed."

And so, during the past few centuries, the whole terrestrial population had streamed up the equatorial Towers and flowed sunwards towards the young oceans of Venus, the fertile plains of Mercury's Temperate Zone. Five hundred years hence, when the sun had recovered, the exiles would return. Mercury would be abandoned, except for the polar regions; but Venus would be a permanent second home. The quenching of the sun had given the incentive, and the opportunity, for the taming of that hellish world.

Important though they were, these matters concerned the Starholmer only indirectly; Its interest was focused upon more subtle aspects of human culture and society. Every species was unique, with its own surprises, its own idiosyncrasies. This one had introduced the Starholmer to the baffling concept of Negative Information - or, in the local terminology, Humour, Fantasy, Myth.

As it grappled with these strange phenomena, the Starholmer had sometimes said despairingly to Itselves: We shall never understand human beings. On occasion It had been so frustrated that It had feared an involuntary conjugation, with all the risks that entailed. But now It had made real progress; It could still remember Its satisfaction the first time It had made a joke - and the children had all laughed.

Working with children had been the clue, again provided by ARISTOTLE. "There is an old saying; the child is father of the man. Although the biological concept of 'father' is equally alien to us both, in this context the word has a double meaning -"

So here It was, hoping that the children would enable It to understand the adults into which they eventually metamorphosed. Sometimes they told the truth; but even when they were being playful (another difficult concept) and dispensed negative information, the Starholmer could now recognise the signs.

Yet there were times when neither the children, nor the adults, nor even ARISTOTLE knew the truth. There seemed to be a continuous spectrum between absolute fantasy and hard historical facts, with every possible graduation in

between. At the one end were such figures as Columbus and Leonardo and Einstein and Lenin and Newton and Washington, whose very voices and images had often been preserved. At the other extreme were Zeus and Alice and King Kong and Gulliver and Siegfried and Merlin, who could not possibly have existed in the real world. But what was one to make of Robin Hood or Tarzan or Christ or Sherlock Holmes or Odysseus or Frankenstein? Allowing for a certain amount of exaggeration, they might well have been actual historic personages.

The Elephant Throne had changed little in three thousand years, but never before had it supported the weight of so alien a visitor. As the Starholmer stared into the south, It compared the half-kilometre-wide column soaring from the mountain peak with the feats of engineering It had seen on other worlds. For such a young race, this was indeed impressive. Though it seemed always on the point of toppling from the sky, it had stood now for fifteen centuries.

Not, of course, in its present form. The first hundred kilometres was now a vertical city-still occupied at some of its widely-spaced levels - through which the sixteen sets of tracks had often carried a million passengers a day. Only two of those tracks were operating now; in a few hours the Starholmer and Its escorts would be racing up that huge, fluted column, on the way back to the Ring City that encircled the globe.

The Holmer everted Its eyes to give telescopic vision, and slowly scanned the zenith. Yes, there it was - hard to see by day, but easy by night when the sunlight streaming past the shadow of Earth still blazed upon it. The thin, shining band that split the sky into two hemispheres was a whole world in itself, where half-a-billion humans had opted for permanent zero-gravity life.

And up there beside Ring City was the starship that had carried the envoy and all the other Companions of the Hive across the interstellar gulfs. Even now it was being readied for departure - not with any sense of urgency, but several years ahead of schedule, in preparation for the next six-hundred-year lap of its journey. That would represent no time at all to the Starholmer, of course, for It would not reconjugate until the end of the voyage, but then It might well face the greatest challenge of Its long career. For the first time a Starprobe had been destroyed - or at least silenced - soon after it had entered a solar system. Perhaps it had at last made contact with the mysterious Hunters of the Dawn, who had left their marks upon so many worlds, so inexplicably close to the Beginning itself. If the Starholmer had been capable of awe, or of fear, It would have known both, as It contemplated its future, six hundred years hence.

But now It was on the snow-dusted summit of Yakkagala, facing mankind's pathway to the stars. It summoned the children to Its side (they always understood when It really wished to be obeyed) and pointed to the mountain in the south.

"You know perfectly well," It said, with an exasperation that was only partly feigned, "that Earthport One was built two thousand years later than this ruined palace." The children all nodded in solemn agreement. "Then why," asked the Starholmer, tracing the line from the zenith down to the summit of the mountain, "why do you call that column - the Tower of Kalidasa?"

AFTERWORD

SOURCES AND ACKOWLEDGMENTS

The writer of historical fiction has a peculiar responsibility to his readers, especially when he is dealing with unfamiliar times and places. He should not distort facts or events, when they are known; and when he invents them, as he is often compelled to do, it is his duty to indicate the dividing line between imagination and reality.

The writer of science fiction has the same responsibility, squared. I hope that these notes will not only discharge that obligation but also add to the reader's enjoyment.

Taprobane and Ceylon

For dramatic reasons, I have made three trifling changes to the geography of Ceylon (now Sri Lanka). I have moved the island eight hundred kilometres south, so that it straddles the equator - as indeed it did twenty million years ago, and may some day do again. At the moment it lies between six and ten degrees north.

In addition, I have doubled the height of the Sacred Mountain, and moved it closer to "Yakkagala". For both places exist, very much as I have described them.

Sri Pada, or Adam's Peak, is a striking cone-shaped mountain sacred to the Buddhists, the Muslims, the Hindus and the Christians, and bearing a small temple on its summit. Inside the temple is a stone slab with a depression which, though two metres long, is reputed to be the footprint of the Buddha.

Every year, for many centuries, thousands of pilgrims have made the long climb to the 2,240-metre-high summit. The ascent is no longer dangerous for there are two stairways (which must surely be the longest in the world) to the very top. I have climbed once, at the instigation of the New Yorker's Jeremy Bernstein (see his Experiencing Science), and my legs were paralysed for several days afterwards. But it was worth the effort, for we were lucky enough to see the beautiful and awe-inspiring spectacle of the peak's shadow at dawn - a perfectly symmetrical cone visible only for the few minutes after sunrise, and stretching almost to the horizon on the clouds far below.

I have since explored the mountain with much less effort in a Sri Lanka Air Force helicopter, getting close enough to the temple to observe the resigned expressions on the faces of the monks, now accustomed to such noisy intrusions.

The rock fortress of Yakkagala is actually Sigiriya (or Sigiri, "Lion Rock"), the reality of which is so astonishing that I have had no need to change it in any way. The only liberties I have taken are chronological, for the palace on the summit was (according to the Sinhalese Chronicle the Culavarnsa) built during the reign of the parricide King Kasyapa I (AD 478-495). However, it seems incredible that so vast an undertaking could have been carried out in a mere

eighteen years by a usurper expecting to be challenged at any moment, and the real history of Sigiriya may well go back for many centuries before these dates.

The character, motivation and actual fate of Kasyapa have been the subject of much controversy, recently fuelled by the posthumous The Story of Sigiri (Lake House, Colombo, 1972), by the Sinhalese scholar Professor Senerat Paranavitana. I am also indebted to his monumental two-volume study of the inscriptions on the Mirror Wall, Sigiri Graffiti (Oxford University Press, 1956). Some of the verses I have quoted are genuine; other I have only slightly invented.

The frescoes which are Sigiriya's greatest glory have been handsomely reproduced in Ceylon: Paintings from Temple, Shrine and Rock (New York Graphic Society/UNESCO, 1957). Plate V shows the most interesting - and the one, alas, destroyed in the 1960's by unknown vandals. The attendant is clearly listening to the mysterious hinged box she is holding in her right hand; it remains unidentified, the local archaeologists refusing to take seriously my suggestion that it is an early Sinhalese transistor radio.

The legend of Sigiriya has recently been brought to the screen by Dimitri de Grunwald in his production The God King, with Leigh Lawson as a very impressive Kasyapa.

The Space Elevator

This apparently outrageous concept was first presented to the West in a letter in the issue of Science for 11 February 1966, "Satellite Elongation into a True 'Sky-Hook' ", by John D. Isaacs, Hugh Bradner and George B. Backus of Scripps Institute of Oceanography, and Allyn C. Vine of Wood's Hole Oceanographic Institute. Though it may seem odd that oceanographers should get involved with such an idea, this is not surprising when one realises that they are about the only people (since the great days of barrage balloons) who concern themselves with very long cables hanging under their own weight. (Dr. Allyn Vine's name, incidentally is now immortalised in that of the famous research submersible "Alvin".) It was later discovered that the concept had already been developed six years earlier - and on a much more ambitious scale - by a Leningrad engineer, Y. N. Artsutanov (Komsomolskaya Pravda, 31 July 1960). Artsutanov considered a "heavenly funicular", to use his engaging name for the device, lifting no less than 12,000 tons a day to synchronous orbit. It seems surprising that this daring idea received so little publicity; the only mention I have ever seen of it is in the handsome volume of paintings by Alexei Leonov and Sokolov, The Stars are Awaiting Us (Moscow 1967). One colour plate (page 25) shows the "Space Elevator" in action; the caption reads: ". . . the satellite will, so to say, stay fixed in a certain point in the sky. If a cable is lowered from the satellite to the earth you will have a ready cable-road. An 'Earth-Sputnik-Earth' elevator for freight and passengers can then be built, and it will operate without any rocket propulsion."

Although General Leonov gave me a copy of his book at the Vienna "Peaceful Uses of Space" Conference in 1968, the idea simply failed to register on me - despite the fact that the elevator is shown hovering exactly over Sri Lanka! I probably thought that Cosmonaut Leonov, a noted humorist*, was just having a little joke.

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* Also a superb diplomat. After the Vienna screening he made quite the nicest comment on 2001 I've ever heard: "Now I feel I've been in space twice." Presumably after the Apollo-Soyuz mission he would say "three times".

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The space elevator is quite clearly an idea whose time has come, as is demonstrated by the fact that within a decade of the 1966 Isaacs letter it was independently re-invented at least three times. A very detailed treatment, containing many new ideas, was published by Jerome Pearson of Wright-Paterson Air Force Base in Acta Astronautica for September-October 1975 ("The Orbital Tower; a spacecraft launcher using the Earth's rotational energy"). Dr. Pearson was astonished to hear of the earlier studies, which his computer survey had failed to locate; he discovered them through reading my own testimony to the House of Representatives Space Committee in July 1975. (See The View From Serendip.)

Six years earlier (Journal of the British Interplanetary Society, Vol. 22, pp. 442-457, 1969) A. R. Collar and J. W. Flower had come to essentially the same conclusions in their paper "A (Relatively) Low Altitude 24-hour Satellite". They were looking into the possibility of suspending a synchronous communications satellite far below the natural 36,000 kilometre altitude, and did not discuss taking the cable all the way down to the surface of the earth, but this is an obvious extension of their treatment.

And now for a modest cough. Back in 1963, in an essay commissioned by UNESCO and published in Astronautics for February 1964, "The World of the Communications Satellite" (now available in Voices From the Sky), I wrote: "As a much longer term possibility, it might be mentioned that there are a number of theoretical ways of achieving a low-altitude, twenty-four-hour satellite; but they depend upon technical developments unlikely to occur in this century. I leave their contemplation as an exercise for the student."

The first of these "theoretical ways" was, of course, the suspended satellite discussed by Collar and Flower. My crude back-of-an-envelope calculations, based on the strength of existing materials, made me so sceptical of the whole idea that I did not bother to spell it out in detail. If I had been a little less conservative - or if a larger envelope had been available - I might have been ahead of everyone except Artsutanov himself.

As this book is (I hope) more of a novel than an engineering treatise, those who wish to go into technical details are referred to the now rapidly expanding literature on the subject. Recent examples include Jerome Pearson's "Using the Orbital Tower to Launch Earth-Escape Payloads Daily" (Proceedings of the 27th International Astronautical Federation Congress, October 1976) and a remarkable paper by Hans Moravec, "A Non-Synchronous Orbital Skyhook" (American Astronautical Society Annual Meeting, San Francisco, 18-20 October 1977).

I am much indebted to my friends the late A. V. Cleaver of Rolls-Royce, Dr. Ing. Harry 0. Ruppe, Professor of Astronautics at the Technical University of Munich's Lehrstuhl für Raumfahrttechnic, and Dr. Alan Bond of the Culham Laboratories for their valuable comments on the Orbital Tower. They are not responsible for my modifications.

Walter L. Morgan (no relation to Vannevar Morgan, as far as I know) and Gary Gordon of the COMSAT Laboratories, as well as L. Perek of the United Nations' Outer Space Affairs Division, have provided most useful information on the stable regions of the synchronous orbit; they point out that natural forces (particularly sun-moon effects) would cause major oscillations, especially in the north-south directions. Thus "Taprobane" might not be as advantageous as I have suggested; but it would still be better than anywhere else.

The importance of a high-altitude site is also debatable, and I am indebted to Sam Brand of the Naval Environmental Prediction Research Facility, Monterey, for information on equatorial winds. If it turns out that the Tower could be safely taken down to sea level, then the Maldivian island of Gan (recently evacuated by the Royal Air Force) may be the twenty-second century's most valuable piece of real estate.

Finally, it Seems a very strange - and even scary - coincidence that, years before I ever thought of the subject of this novel, I myself should have unconsciously gravitated (sic) towards its locale. For the house I acquired a decade ago on my favourite Sri Lankan beach (see The Treasure of the Great Reef and The View From Serendip) is at precisely the closest spot on any large body of land to the point of maximum geosynchronous stability.

So in my retirement I hope to watch the other superannuated relics of the Early Space Age, milling around in the orbital Sargasso Sea immediately above my head.

Colombo

1969-1978

And now, one of those extraordinary coincidences I have learned to take for granted.

While correcting the proofs of this novel, I received from Dr. Jerome Pearson a copy of NASA Technical Memorandum TM-75174, "A Space 'Necklace' About the Earth" by G. Polyakov. This is a translation of "Kosmicheskoye 'Ozherel'ye' Zemli", published in Teknika Moloa'ezhi, No 4, 1977, pp. 41-43.

In this brief but stimulating paper, Dr. Polyakov, of the Astrakhan Teaching Institute, describes in precise engineering details Morgan's final vision of a continuous ring around the world. He sees this as a natural extension of the space elevator, whose construction and operation he also discusses in a manner virtually identical with my own treatment.

I salute tovarich Polyakov, and am beginning to wonder if - yet again, I have been too conservative. Perhaps the Orbital Tower may be an achievement of the twenty-first century, not the twenty-second.

Our own grandchildren may demonstrate that - sometimes - Gigantic is Beautiful.

Colombo

18 September 1978

BLAST OFF!

"Between the first and last decades of the Twentieth Century lay a gulf greater than the wildest imagination could have conceived. It was the gulf between gunpowder and nuclear bomb, between messages tapped in morse code and global television from the sky, between Queen Victoria, Empress of India, and Kwame Chaka, Supreme President of the African Federation. But above all, it was the gulf between the first hundred-foot flight at Kitty Hawk, and the first billion mile mission to the moons of Jupiter. . . ."

This was the beginning of the first version of 2001-the version that never was published. Now at last you can go that first great voyage . . . a trip far different than that of 2001 . . . an adventure in many ways even stranger and more fascinating . . . as you move through time and space toward the extraordinary revelation that awaits you in-

THE LOST WORLDS OF 2001
ARTHUR C. CLARKE
A SIGNET BOOK from
NEW AMERICAN LIBRARY
TIMES MIRROR

"Sorry to interrupt the festivities, but we have a problem."

(HAL 9000, during Frank Poole's birthday party)

"Houston, we've had a problem." (Jack Swigert, shortly after playing the Zarathustra theme to his TV audience, aboard Apollo 13 Command Module Odyssey)

CONTENTS

FOREWORD

Behind every man now alive stand thirty ghosts, for that is the ratio by which the dead outnumber the living. Since the dawn of time, roughly a hundred billion human beings have walked the planet Earth.

So began the novel 2001: A Space Odyssey when it was published in July 1968. But the first version, four years earlier, had started like this....

VIEW FROM THE YEAR 2000

Between the first and last decades of the twentieth century lay a gulf greater than the wildest imagination could have conceived. It was the gulf between gunpowder and nuclear bomb, between messages tapped in Morse and global television from the sky, between Queen Victoria, Empress of India, and Kwame Chaka, Supreme President of the African Federation. But above all it was the gulf between the first hundred-foot flight at Kitty Hawk, and the first billion-mile mission to the moons of Jupiter. All of these things, ages apart in terms of culture, lay within the span of that one incredible century.

The thunder of doom had barely ceased to roll above Eniwetok Atoll when the first Sputnik rose beeping into the sky. Across the constellations moved stars that no astronomers had seen before, and as the ancient dust of the Sea of Rains received the first emissary from Earth, the long loneliness of the Moon was ended forever.

Barely a moment later, as the universe counts time, Man followed his messengers into space. Project Apollo, dominating the '70's like a bloodless war, was to pass into history, with all its triumphs and tragedies. After that, nothing would ever again be the same. When men raised their eyes to the Moon, they would know that their comrades were looking down at them. And they would remember that there were some whom Earth could never reclaim, as it had gathered back all their ancestors since the beginning of time. These were the voyagers who had failed to reach their goals, but had won instead the immortality of space, and were beyond change or decay.

Before the '70's had ended, the first permanent colony had been established on the Moon. The cost of space travel had been slashed tenfold, and would be cut tenfold again with coming of nuclear power. The brief age of the rocket dinosaurs, each capable of but a single flight, was drawing to its close. Instead of the thousand-ton boosters whose bones now littered the Atlantic deeps, men were building far more efficient aerospace planes-giant rocket aircraft which could- climb up to orbit with their cargoes, then return to Earth for another mission. Commercial space flight had not yet been achieved, but it was on the horizon.

Only a few percent of the Moon's millions of square miles had been thoroughly explored, and the detailed examination of its vast wilderness might take centuries yet. But no one believed that it held any more surprises; it was hostile but familiar territory, and the home of more than a thousand men. The real frontier was far away, in the cold night beyond the path of Mars, the searing day inside the orbit of Venus.

Herald of the dawn, star of evening, Venus had been the first bitter disappointment of the space age. Even after Mariner II had reported the furnace heat of the eternally hidden surface, there were some who had hoped that the instruments might be wrong. But now, too many probes had been lost in the howling hell of the Cytherean atmosphere for any optimism to remain. Venus was dead; perhaps one day men would bring her to life, but that would be in the far, far future, with the aid of technologies yet unborn.

There remained Mars, source of so much mystery and romance, perhaps the only other home of life in the Solar System. After heartbreaking failures, a TV scanner was landed on the planet, and the whole world peered from forty million miles away, through a single mobile eye rolling jerkily across the desolation of the misnamed Lake of the Sun.

No one who saw will ever forget that first encounter between Martian and machine. Undramatic, absolutely silent, it was one of the great moments of history. Advancing slowly on its broad balloon tires, its vision turret rotating continuously, the exploring robot moved with mindless purpose over a dry, dusty plain. It was on its own, beyond aid or advice from Earth. The scenes its makers were watching were already four minutes in the past: any orders they might send, though racing at the speed of light, could not reach Mars until as many in the future.

The plain was covered with large, spherical boulders, and the robot was rolling straight toward one. Its builders were not worried; the machine's obstacle-detecting skirt would warn it before there was danger of collision, and it would automatically turn off at a right angle. That was the theory; what happened was somewhat different.

Before the robot could reach it, the boulder moved. It heaved itself off the ground on a myriad stumpy legs, crawled slowly out of the track of the advancing explorer, and settled down again. As it plunged forward, unaware of the consternation it was causing on Earth and Mars, the robot disturbed two more of the boulders; then it was through them, and encountered no others until, ten hours later, it became trapped in a canyon and continued to radio back maddeningly repetitious views of bare rock until its batteries failed.

But it had done its work; it had detected life on Mars- life, moreover, of a fairly advanced form. Whether animal, vegetable, or neither, was a question

that would not be answered for years-until the first expedition reached the planet in the mid-80's.

The early explorers knew that they would find life: they could only hope that they would find intelligence. But Mars has as much land area as Earth-for though it is a small world, it has no seas. Even to map the planet adequately would take decades; to learn all its secrets would be the work of centuries.

The main Martian life-forms-the "roving stones" browsing on the mineral deserts, the leechlike predators that hunted them in the desperate battle for existence, the yet fiercer parasites that preyed on them-showed only the dimmest flickers of intelligence. Nor was there any sign that these were the degenerate survivors of superior creatures, Mars, it appeared certain, had never been the home of Mind. Yet there were still-many who hoped that somewhere in the endless crimson deserts or beneath the frozen poles, or sealed in the eroded hills there might yet be found the relics of civilizations that had flourished when the giant reptiles ruled the Earth. It was a romantic dream, and it would be slow to die.

Beyond Mars, there were greater worlds, and mightier problems. Enigmatic Jupiter, with a thousand times the bulk of Earth, teased the minds of men with its mysteries. Perhaps there was life far beneath those turbulent clouds of ammonia and methane, thriving in the hot darkness at pressures unmatched in the deepest terrestrial seas. If so, it would be as unreachable as another universe; for no ship yet imagined could fight its way down through that immense gravitational field, or withstand the forces that were raging in the Jovian atmosphere. Some robot probes had been launched on that fearful journey; none had survived.

One day, perhaps in the early years of the new century, there would be manned expeditions to the moons of Jupiter-to Io, Europa, Ganymede and Callisto, the beloved of the father of the gods, large enough to be called planets in their own right. But there was so much to do nearer home, with the buildup of the lunar colony and the establishment of a bridgehead on Mars, that the outer worlds must wait. Though there would be robot fly-by missions to all the giant planets, and even out into the comet-haunted darkness beyond Pluto, no men would travel on these lonely flights.

As for voyaging outside the Solar System, to the still undiscovered planets of other stars, few scientists believed that it would ever be possible. At the best, interstellar travel was certainly a dream of the very distant future, of no practical concern during the first few centuries of space flight.

That was a very sensible, very reasonable prediction, repeated over and over again in the writings of the '70's and '80's. For who could possibly have guessed-

SON OF DR. STRANGELOVE

Who could, indeed?

Those words were written five years before the first men reached the Moon: now, ironically enough, it seems that, far from "dominating the '70's," Project Apollo has been dominated by them, it has shrunk pitifully from the original plan of ten lunar missions. But if we survive our present Time of Troubles, history will restore the correct perspective. An age may come when Project

Apollo is the only thing by which most men remember the United States-or even the world of their ancestors, the distant planet Earth.

Yet when Stanley Kubrick wrote to me in the spring of 1964, saying that he wanted to make the "proverbial good science-fiction movie," the lunar landing still seemed, psychologically, a dream of the far future. Intellectually, we knew that it was inevitable; emotionally, we could not really believe it-as indeed, some foolish people do not believe it even now.

To put early 1964 in perspective: it was eleven months since an American astronaut (Gordon Cooper-Mercury 9) had been in space; the first two-man Gemini flight (Grissom and Young) would not take place for another year; and argument was still raging about the nature of the lunar surface, owing to the heartbreaking failure of Ranger VI's TV cameras fifteen minutes before impact.

Though there was great activity behind the scenes, and NASA was spending the entire budget of our movie (over $10,000,000) every day, space exploration seemed to be marking time. But the portents were clear; I often reminded Stanley-and myself-that the film would still be on its first run when men were actually walking on the Moon. This turned out to be a considerable understatement; the Toronto release, for example, spanned Apollos 11, 12 and 13....

Our main problem, therefore, was creating a story which would not be made obsolete-or even worse, ridiculous-by the events of the next few years. We had to outguess the future; one way of doing that was to be so far ahead of the present that there was no danger of facts overtaking us. On the other hand, if we got too far ahead there would be a grave risk of losing contact with our audience. Though MGM'e motto has long been Ars Gratia artis, it is no great secret that movie companies exist to make money. We had to aim for an audience of about a hundred million-give or take a million, as General Turgidson would say.

Even before I left Ceylon to join Stanley in April 1964, I had run through my published stories in search of a suitable starting point for a space epic. Almost at once, I settled upon a very short piece called The Sentinel, written during the 1948 Christmas holiday for a BBC competition. (It wasn't placed, and I'd like to know what did win.) It is a story of the pioneering days of lunar exploration (1980+?); though it has been widely anthologized, and appears in my own collections Expedition to Earth and The Nine Billion Names of God, it is such an essential introduction to 2001 that I would like to repeat it here. Over, then, to The Sentinel, . . .

THE SENTINEL

The next time you see the full moon high in the south, look carefully at its right-hand edge and let your eye travel upward along the curve of the disk. Round about two o'clock you will notice a small, dark oval: anyone with normal eyesight can find it quite easily. It is the great walled plain, one of the finest on the Moon, known as the Mare Crisium-the Sea of Crises. Three hundred miles in diameter, and almost completely surrounded by a ring of magnificent mountains, it had never been explored until we entered it in the late summer of 1996.

Our expedition was a large one. We had two heavy freighters which had flown our supplies and equipment from the main lunar base in the Mare Serenitatis, five hundred miles away. There were also three small rockets which were intended

for short-range transport over regions which our surface vehicles couldn't cross. Luckily, most of the Mare Crisium is very flat. There are none of the great crevasses so common and so dangerous elsewhere, and very few craters or mountains of any size. As far as we could tell, our powerful caterpillar tractors would have no difficulty in taking us wherever we wished to go.

I was geologist-or selenologist, if you want to be pedantic-in charge of the group exploring the southern region of the Mare. We had crossed a hundred miles of it in a week, skirting the foothills of the mountains along the shore of what was once the ancient sea, some thousand million years before. When life was beginning on Earth, it was already dying here. The waters were retreating down the flanks of those stupendous cliffs, retreating into the empty heart of the Moon. Over the land which we were crossing, the tideless ocean had once been half a mile deep, and now the only trace of moisture was the hoarfrost one could sometimes find in caves which the searing sunlight never penetrated.

We had begun our journey early in the slow lunar dawn, and still had almost a week of Earth time before nightfall. Half a dozen times a day we would leave our vehicle and go outside in the space suits to hunt for interesting minerals, or to place markers for the guidance of future travelers. It was an uneventful routine. There is nothing hazardous or even particularly exciting about lunar exploration. We could live comfortably for a month in our pressurized tractors, and if we ran into trouble we could always radio for help and sit tight until one of the spaceships came to our rescue.

I said just now that there was nothing exciting about lunar exploration, but of course that isn't true. One could never grow tired of those incredible mountains, so much more rugged than the gentle hills of Earth. We never knew, as we rounded the capes and promontories of that vanished sea, what new splendors would be revealed to us. The whole southern curve of the Mare Crisium is a vast delta where a score of rivers once found their way into the ocean, fed perhaps by the torrential rains that must have lashed the mountains in the brief volcanic age when the Moon was young. Each of these ancient valleys was an invitation, challenging us to climb into the unknown uplands beyond. But we had a hundred miles still to cover, and could only look longingly at the heights which Others must scale.

We kept Earth time aboard the tractor, and precisely at 2200 hours the final radio message would be sent out to Base and we would close down for the day. Outside, the rocks would still be burning beneath the almost vertical sun, but to us it was night until we awoke again eight hours later. Then one of us would prepare breakfast, there would be a great buzzing of electric razors, and someone would switch on the shortwave radio from Earth. Indeed, when the smell of frying sausages began to fill the cabin, it was sometimes hard to believe that we were not back on our own world-everything was so normal and homely, apart from the feeling of decreased weight and the unnatural slowness with which objects fell.

It was my turn to prepare breakfast in the corner of the main cabin that served as a galley. I can remember that moment quite vividly after all these years, for the radio had just played one of my favorite melodies, the old Welsh air "David of the White Rock." Our driver was already outside in his space suit, inspecting our caterpillar treads. My assistant, Louis Garnett, was up forward in the control position, making some belated entries in yesterday's log.

As I stood by the frying pan waiting, like any terrestrial housewife, for the sausages to brown, I let my gaze wander idly over the mountain walls which

covered the whole of the southern horizon, marching out of sight to east and west below the curve of the moon. They seemed only a mile or two from the tractor, but I knew that the nearest was twenty miles away. On the Moon, of course, there is no loss of detail with distance-none of that almost imperceptible haziness which softens and sometimes transfigures all far-off things on Earth.

Those mountains were ten thousand feet high, and they climbed steeply out of the plain as if ages ago some subterranean eruption had smashed them skyward through the molten crust. The base of even the nearest was hidden from sight by the steeply curving surface of the plain, for the Moon is a very little world, and from where I was standing the horizon was only two miles away.

I lifted my eyes toward the peaks which no man had ever climbed-the peaks which, before the coming of terrestrial life, had watched the retreating oceans sink sullenly into their graves, taking with them the hope and the morning promise of a world. The sunlight was beating against those ramparts with a glare that hurt the eyes, yet only a little way above them the stars were shining steadily in a sky blacker than a winter midnight on Earth.

I was turning away when my eye caught a metallic glitter high on the ridge of a great promontory thrusting out into the sea thirty miles to the west. It was a dimensionless point of light, as if a star had been clawed from the sky by one of those cruel peaks, and I imagined that some smooth rock surface was catching the sunlight and heliographing it straight into my eyes. Such things were not uncommon. When the moon is in her second quarter, observers on Earth can sometimes see the great ranges in the Oceanus Procellarum burning with a blue-white iridescence as the sunlight flashes from their slopes and leaps again from world to world. But I was curious to know what kind of rock could be shining so brightly up there, and I combed the observation turret and swung our four-inch telescope round to the west.

I could see just enough to tantalize me. Clear and sharp in the field of vision, the mountain peaks seemed only half a mile away, but whatever was catching the sunlight was still too small to be resolved. Yet it seemed to have an elusive symmetry, and the summit upon which it rested was curiously flat. I stared for a long time at that glittering enigma, straining my eyes into space, until presently a smell of burning from the galley told me that our breakfast sausages had made their quarter-million-mile journey in vain.

All that morning we argued our way across the Mare Crisium while the western mountains reared higher in the sky. Even when we were out prospecting in the space suits, the discussion would continue over the radio. It was absolutely certain, my companions argued, that there had never been any form of intelligent life on the Moon. The only living things that had ever existed there were a few primitive plants and their slightly less degenerate ancestors. I knew that as well as anyone, but there are times when a scientist must not be afraid to make a fool of himself.

"Listen," I said at last, "I'm going up there, if only for my own peace of mind. That mountain's less than twelve thousand feet high-that's only two thousand under Earth gravity-and I can make the trip in twenty hours at the outside. I've always wanted to go up into those hills, anyway, and this gives me an excellent excuse."

"If you don't break your neck," said Garnett, "you'll be the laughing stock of the expedition when we get back to Base. That mountain will probably be named Wilson's Folly from now on."

"I won't break my neck," I said firmly. "who was the first man to climb Pico and Helicon?"

"But weren't you rather younger in those days?" asked Louis gently.

"That," I said with great dignity, "is as good a reason as any for going."

We went to bed early that night, after driving the tractor to within half a mile of the promontory. Garnett was coming with me in the morning; he was a good climber, and had often been with me on such exploits before. Our driver was only too glad to be left in charge of the machine.

At first sight, those cliffs seemed completely unscalable, but to anyone with a good head for heights, climbing is easy on a world where all weights are only a sixth of their normal value. The real danger in lunar mountaineering lies in overconfidence, a six-hundred-foot drop on the moon can kill you just as thoroughly as a hundred-foot fall on Earth.

We made our first halt on a wide ledge about four thousand feet above the plain. Climbing had not been very difficult, but my limbs were stiff with the unaccustomed effort, and I was glad of the rest. We could still see the tractor as a tiny metal insect far down at the foot of the cliff, and we reported our progress to the driver before starting on the next ascent.

Inside our suits it was comfortably cool, for the refrigeration units were fighting the fierce sun and carrying away the body heat of our exertions. We seldom spoke to each other, except to pass climbing instructions and to discuss our best plan of ascent. I do not know what Garnett was thinking; probably that this was the craziest wild-goose chase he had ever embarked upon. I more than half agreed with him, but the joy of climbing, the knowledge that no man had ever gone this way before and the exhilaration of the steadily widening landscape gave me all the reward I needed.

I don't think I was particularly excited when I saw in front of us the wall of rock I had first inspected through the telescope from thirty miles away. It would level off about fifty feet above our heads, and there on the plateau would be the thing that had lured me over these barren wastes. It was, almost certainly, nothing more than a boulder splintered ages ago by a falling meteor, and with its cleavage planes still fresh and bright in this incorruptible, unchanging silence.

There were no handholds on the rock face, and we had to use a grapnel. My tired arms seemed to gain new strength as I swung the three-pronged metal anchor round my head and sent it sailing up toward the stars. The first time, it broke loose and came falling slowly back when we pulled the rope. On the third attempt, the prongs gripped firmly and our combined weights could not shift it.

Garnett looked at me anxiously. I could tell that he wanted to go first, but I smiled back at him through the glass of my helmet and shook my head. Slowly, taking my time, I began the final ascent.

Even with my space suit, I weighed only forty pounds here, so I pulled myself up hand over hand without bothering to use my feet. At the rim I paused

and waved to my companion; then I scrambled over the edge and stood upright, staring ahead of me.

You must understand that until this very moment I had been almost completely convinced that there could be nothing strange or unusual for me to find here. Almost, but not quite; it was that haunting doubt that had driven me forward. Well, it was a doubt no longer, but the haunting had scarcely begun.

I was standing on a plateau perhaps a hundred feet across. It had once been smooth-too smooth to be natural-but fading meteors had pitted and scored its surface through immeasurable eons. It had been leveled to support a glittering, roughly pyramidal structure, twice as high as a man, that was set in the rock like a gigantic, many-faceted jewel.

Probably no emotion at all filled my mind in those first few seconds. Then I felt a great lifting of my heart, and a strange, inexpressible joy. For I loved the Moon, and now I knew that the creeping moss of Aristarchus and Eratosthenes was not the only life she had brought forth in her youth. The old, discredited dream of the first explorers was true. There had, after all, been a lunar civilization- and I was the first to find it. That I had come perhaps a hundred million years too late did not distress me; it was enough to have come at all.

My mind was beginning to function normally, to analyze and to ask questions. Was this a building, a shrine- or something for which my language had no name? If a building, then why was it erected in so uniquely inaccessible a spot? I wondered if it might be a temple, and I could picture the adepts of some strange priesthood calling on their gods to preserve them as the life of the Moon ebbed with the dying oceans-and calling on their gods in vain.

I took a dozen steps forward to examine the thing more closely, but some sense of caution kept me from going too near. I knew a little archaeology, and tried to guess the cultural level of the civilization that must have smoothed this mountain and raised the glittering mirror surfaces that still dazzled my eyes.

The Egyptians could have done it, I thought, if their workmen had possessed whatever strange materials these far more ancient architects had used. Because of the thing's smallness, it did not occur to me that I might be looking at the handiwork of a race more advanced than my own. The idea that the moon had possessed intelligence at all was still almost too tremendous to grasp, and my pride would not let me take the final, humiliating plunge.

And then I noticed something that set the scalp crawling at the back of my neck-something so trivial and so innocent that many would never have noticed it at all. I have said that the plateau was scarred by meteors; it was also coated inches deep with the cosmic dust that is always filtering down upon the surface of any world where there are no winds to disturb it. Yet the dust and the meteor scratches ended quite abruptly in a wide circle enclosing the little pyramid, as though an invisible wall was protecting it from the ravages of time and the slow but ceaseless bombardment from space.

There was someone shouting in my earphones, and I realized that Garnett had been calling me for some time. I walked unsteadily to the edge of the cliff and signaled him to join me, not trusting myself to speak. Then I went back toward that circle in the dust. I picked up a fragment of splintered rock and tossed it gently toward the shining enigma. If the pebble had vanished at that invisible

barrier I should not have been surprised, but it seemed to hit a smooth, hemispherical surface and slide gently to the ground.

I knew then that I was looking at nothing that could be matched in the antiquity of my own race. This was not a building but a machine, protecting itself with forces that had challenged Eternity. Those forces, whatever they might be, were still operating, and perhaps I had already come too close. I thought of all the radiations man had trapped and tamed in the past century. For all I knew, I might be as irrevocably doomed as if I had stepped into the deadly, silent aura of an unshielded atomic pile.

I remember turning then toward Garnett, who had joined me and was now standing motionless at my side. He seemed quite oblivious to me, so I did not disturb him but walked to the edge of the cliff in an effort to marshal my thoughts. There below me lay the Mare Crisium - Sea of Crises, indeed-strange and weird to most men, but reassuringly familiar to me. I lifted my eyes toward the crescent Earth, lying in her cradle of stars, and I wondered what her clouds had covered when these unknown builders had finished their work. Was it the steaming jungle of the Carboniferous, the bleak shoreline over which the first amphibians must crawl to conquer the land-or, earlier still, the long loneliness before the coming of life?

Do not ask me why I did not guess the truth sooner- the truth that seems so obvious now. In the first excitement of my discovery, I had assumed without question that this crystalline apparition had been built by some race belonging to the Moon's remote past, but suddenly, and with overwhelming force, the belief came to me that it was as alien to the Moon as I myself.

In twenty years we had found no trace of life but a few degenerate plants. No lunar civilization, whatever its doom, could have left but a single token of its existence.

I looked at the shining pyramid again, and the more remote it seemed from anything that had to do with the Moon. And suddenly I felt myself shaking with a foolish, hysterical laughter, brought on by excitement and overexertion: for I had imagined that the little pyramid was speaking to me and was saying: "Sorry, I'm a stranger here myself."

It has taken us twenty years to crack that invisible shield and to reach the machine inside those crystal walls. What we could not understand, we broke at last with the savage might of atomic power, and now I have seen the fragments of the lovely, glittering thing I found up there on the mountain.

They are meaningless. The mechanisms-if indeed they are mechanisms-of the pyramid belong to a technology that lies far beyond our horizon, perhaps to the technology of paraphysical forces.

The mystery haunts us all the more now that the other planets have been reached and we know that only Earth has ever been the home of intelligent life in our Solar System. Nor could any lost civilization of our own world have built that machine, for the thickness of the meteoric dust on the plateau has enabled us to measure its age. It was set there upon its mountain before life had emerged from the seas of Earth.

When our world was half its present age, something from the stars swept through the Solar System, left this token of its passage, and went again upon

its way. Until we destroyed it, that machine was still fulfilling the purpose of its builders; and as to that purpose, here is my guess.

Nearly a hundred thousand million stars are turning in the circle of the Milky Way, and long ago other races on the worlds of other suns must have scaled and passed the heights that we have reached. Think of such civilizations, far back in time against the fading afterglow of Creation, masters of a universe so young that life as yet had come to only a handful of worlds. Theirs would have been a loneliness we cannot imagine, the loneliness of gods looking out across infinity and finding none to share their thoughts.

They must have searched the star clusters as we have searched the planets. Everywhere there would be worlds, but they would be empty or peopled with crawling, mindless things. Such was our own Earth, the smoke of the great volcanoes still staining the skies, when that first ship of the peoples of the dawn came sliding in from the abyss beyond Pluto. It passed the frozen outer worlds, knowing that life could play no part in their destinies. It came to rest among the inner planets, warming themselves around the fire of the sun and waiting for their stories to begin.

Those wanderers must have looked on Earth, circling safely in the narrow zone between fire and ice, and must have guessed that it was the favorite of the sun's children. Here, in the distant future, would be intelligence; but there were countless stars before them still, and they might never come this way again.

So they left a sentinel, one of millions they have scattered throughout the Universe, watching over all worlds with the promise of life. It was a beacon that down the ages has been patiently signaling the fact that no one had discovered it.

Perhaps you understand now why that crystal pyramid was set upon the Moon instead of on the Earth. Its builders were not concerned with races still struggling up from savagery. They would be interested in our civilization only if we proved our fitness to survive-by crossing space and so escaping from the Earth, our cradle. That is the challenge that all intelligent races must meet, sooner or later. It is a double challenge, for it depends in turn upon the conquest of atomic energy and the last choice between life and death.

Once we had passed that crisis, it was only a matter of time before we found the pyramid and forced it open. Now its signals have ceased, and those whose duty it is will be turning their minds upon Earth. Perhaps they wish to help our infant civilization. But they must be very, very old, and the old are often insanely jealous of the young.

I can never look now at the Milky Way without wondering from which of those banked clouds of stars the emissaries are coming. If you will pardon so commonplace a simile, we have set off the fire alarm and have nothing to do but to wait.

I do not think we will have to wait for long.

CHRISTMAS, SHEPPERTON

When I met Stanley Kubrick for the first time, in Trader Vic's on April 22, 1964, he had already absorbed an immense amount of science fact and science fiction, and was in some danger of believing in flying saucers; I felt I had

arrived just in time to save him from this gruesome fate. Even from the beginning, he had a very clear idea of his ultimate goal, and was searching for the best way to approach it. He wanted to make a movie about Man's relation to the universe-something which had never been attempted, still less achieved, in the history of motion pictures.* Of course, there had been innumerable "space" movies, most of them trash. Even the few that had been made with some skill and accuracy had been rather simpleminded, concerned more with the schoolboy excitement of space flight than its profound implications to society, philosophy, and religion.

Stanley was fully aware of this, and he was determined to create a work of art which would arouse the emotions of wonder, awe . . . even, if appropriate, terror. How he set about it I have described elsewhere (see "Son of Dr. Strangelove: or How I Learned to Stop Worrying and love Stanley Kubrick"- reprinted in Report on Planet Three, Harper & Row). His success has been recorded or disputed in millions of spoken and written words, a fair sampling of which will be found in Jerry Agel's entertaining book The Making of Kubrick's 2001 (New American Library). I am concerned here, however, not with the movie but with the novel, regarded as an independent and self-contained work-even though it was created specifically as the basis for the movie.

* I once accused my friends in MGM's publicity department of having a special labor-saving key on their typewriters which, when pressed, automatically began to print out: "Never, in the history of motion pictures ...."

This, of course, is the reverse of the usual state of affairs. Most movies are adapted from already existing novels, preferably ones which have proved to be best sellers and so have a built-in box- office guarantee. (Good examples are Gone with the Wind and Doctor Zhivago.) Other movies are based on screenplays specifically written for them, and no novel version (or even-ugh!- "novelization") ever exists. All of Chaplin's films, Citizen Kane, and Lawrence of Arabia are in this category. They were conceived purely as movies from start to finish, the only thing that exists on paper is the screenplay and the subsequent shooting script.*

* The screenplay gives the dialogue, action, scenes, etc. in the order in which they will actually appear on the screen. But it would be absurd to film them in this order, so the shooting script groups together all the scenes involving the same locations, sets and actors.

Some directors of genius have even managed to dispense with these. Though it seems incredible, David Wark Griffiths is supposed to have carried Intolerance entirely in his head. I think that Stanley would like to have done the same with 2001, and would hesitate to say that, for him, it was theoretically impossible. But it was certainly impossible in practice-if only for the reason that he had to have a fairly complete treatment to show his backers. Banks and movie companies require more than a few notes on scraps of paper before they will disgorge their cherished millions.

Now a screenplay is not a work of art, though its production requires considerable skill. It bears somewhat the same relationship to a movie as the musical score does to a symphonic performance. There are people who can read a musical score and "hear" the symphony-but no two directors will see the same images when they read a movie script. The two-dimensional patterns of colored light involved are far more complex than the one-dimensional thread of sound- which can, in principle, be completely described on paper. A movie can never be pinned down in such a way, though the scriptwriter has to attempt this

impossible feat. Unless the writer is the director, everything has to be specified in boring detail; no wonder that screenplays are almost as tedious to read as to write. John Fowles has put it very well: "Any novelist who has written scripts knows the appalling restrictions- obligatory detailing of the unnecessary-the cinema imposes. Writing a novel is like swimming in the sea; writing a film script is thrashing through treacle." ("Is the Novel Dead?"- Books, Autumn 1970).

Though I was only dimly aware of this in 1964, Stanley knew it very well. It was his suggestion that, before embarking on the drudgery of the script, we let our imaginations soar freely by developing the story in the form of a complete novel. Of course, to do this we would have to generate far more background than could ever be used in the final film. That wouldn't matter. Every good novelist "knows" much more than he writes down: every film maker should be aware of a larger universe than his script.

In theory, therefore, the novel would be written (with an eye on the screen) and the script would be derived from this. In practice, the result was far more complex; toward the end, both novel and screenplay were being written simultaneously, with feedback in both directions. Some parts of the novel had their final revisions after we had seen the rushes based on the screenplay based on earlier versions of the novel . . . and so on.

After a couple of years of this, I felt that when the novel finally appeared it should be "by Arthur Clarke and Stanley Kubrick; based on the screenplay by Stanley Kubrick and Arthur Clarke"-whereas the movie should have the credits reversed. This still seems the nearest approximation to the complicated truth.

After various false starts and twelve-hour talkathons, by early May 1964 Stanley agreed that "The Sentinel" would provide good story material. But our first concept-and it is hard now for me to focus on such an idea, though it would have been perfectly viable-involved working up to the discovery of an extraterrestrial artifact as the climax, not the beginning, of the story. Before that, we would have a series of incidents or adventures devoted to the exploration of the Moon and Planets. For this Mark I version, our private title (never of course intended for public use) was "How the Solar System Was Won."

So once more I went back to my stockpile of short stories, to find material which would fit into this pattern. I returned with five: "Breaking Strain" (from Expedition to Earth); "Out of the Cradle, Endlessly Orbiting . . .", "Who's There?", "Into the Comet", and "Before Eden" (all from Tales of Ten Worlds). On May 28, 1964, I sold the lot to Stanley and signed an agreement to work on the projected movie. Our initial schedule was hilariously optimistic: writing script, 12 weeks; discussing it, 2 weeks; revising, 4 weeks; fixing deal, 4 weeks; visuals, art, 20 weeks; shooting, 20 weeks; cutting, editing, 20 weeks-a total of 82 weeks. Allowing another 12 weeks before release, this added up to 92, or the better part of two years. I was very depressed by this staggering period of time, since I was (as always) in a hurry to get back to Ceylon, it was just as well that neither of us could have guessed the project's ultimate duration-four years....

The rest of 1964 was spent brainstorming. As we developed new ideas, so the original conception slowly changed. "The Sentinel" became the opening, not the finale; and one by one, the other five short stories were discarded. A year later, deciding (not necessarily in this order) that (a) it wasn't fair to

Stanley to make him pay for something he didn't need and (b) these stories might make a pretty good movie someday, I bought them back from him....

The announced title of the project, when Stanley gave his intentions to the press, was Journey Beyond the Stars. I never liked this, because there had been far too many science-fictional journeys and voyages. (Indeed, the innerspace epic Fantastic Voyage, featuring Raquel Welch and a supporting cast of ten thousand blood corpuscles, was also going into production about this time.) Other titles which we ran up and failed to salute were Universe, Tunnel to the Stars, and Planetfall. It was not until eleven months after we started-April 1965-that Stanley selected 2001: A Space Odyssey. As far as I can recall, it was entirely his idea.

Despite the unrelenting pressure of work (a mere twelve hours was practically a day off) I kept a detailed log of the whole operation. Though I do not wish to get bogged down in minutiae of interest only to fanatical Kubrickologists, perhaps these extracts may convey the flavor of those early days:-

May 28, 1964. Suggested to Stanley that "they" might be machines who regard organic life as a hideous disease. Stanley thinks this is cute and feels we've got something.

May 31. One hilarious idea we won't use. Seventeen aliens-featureless black pyramids-riding in open cars down Fifth Avenue, surrounded by Irish cops.

June 20. Finished the opening chapter, "View from the Year 2000," and started on the robot sequence.

July 1. Last day working at Time/Life completing Man and Space. Checked into new suite, 1008, at the Hotel Chelsea.

July 2-8. Averaging one or two thousand words a day. Stanley reads first five chapters and says "We've got a best seller here."

July 9. Spent much of afternoon teaching Stanley how to use the slide rule-he's fascinated.

July 11. Joined Stanley to discuss plot development, but spent almost all the time arguing about Cantor's Theory of Transfinite Groups. Stanley tries to refute the "part equals the whole" paradox by arguing that a perfect square is not necessarily identical with the integer of the same value. I decide that he is a latent mathematical genius.

July 12. Now have everything-except the plot.

July 13. Got to work again on the novel and made good progress despite the distraction of the Republican Convention.

July 26. Stanley's birthday. Went to the Village and found a card showing the Earth coming apart at the seams and bearing the inscription: "How can you have a Happy Birthday when the whole world may blow up any minute?"

July 28. Stanley: "What we want is a smashing theme of mythic grandeur."

August 1. Ranger VII impacts on moon. Stay up late to watch the first TV closeups. Stanley starts to worry about the forthcoming Mars probes. Suppose

they show something that shoots down our story line? [Later he approached Lloyd's of London to see if he could insure himself against this eventuality.]

August 6. Stanley suggests that we make the computer female and call her Athena.

August 17. We've also got the name of our hero at last- Alex Bowman. Hurrah!

August 19. Writing all day. Two thousand words exploring Jupiter's satellites. Dull work.

September 7. Stanley quite happy: "We're in fantastic shape." He has made up a 100-item questionnaire about our astronauts, e.g. do they sleep in their pajamas, what do they eat for breakfast, etc.

September 8. Upset stomach last night. Dreamed I was a robot, being rebuilt. In a great burst of energy managed to redo two chapters. Took them to Stanley, who was very pleased and cooked me a fine steak, remarking: "Joe Levine doesn't do this for his writers."

September 26. Stanley gave me Joseph Campbell's analysis of the myth The Hero with a Thousand Faces to study. Very stimulating.

September 29. Dreamed that shooting had started. Lots of actors standing around, but I still didn't know the story line.

October 2. Finished reading Robert Ardrey's African Genesis. Came across a striking paragraph which might even provide a title for the movie: "Why did not the human line become extinct in the depths of the Pliocene? . . . we know that but for a gift from the stars, but for the accidental collision of ray and gene, intelligence would have perished on some forgotten African field." True, Ardrey is talking about cosmic-ray mutations, but the phrase "A gift from the stars" is strikingly applicable to our present plot line.

October 6. Have got an idea which I think is crucial. The people we meet on the other star system are humans who were collected from Earth a hundred thousand years ago, and hence are virtually identical with us.

October 8. Thinking of plot all morning, but after a long walk in the sun we ended up on the East River watching the boats. We dumped all our far-fetched ideas-now we're settling for a Galactic Peace Corps and no blood and thunder.

October 17. Stanley has invented the wild idea of slightly fag robots who create a Victorian environment to put our heroes at their ease.

November 20. Went to Natural History Museum to see Dr. Harry Shapiro, head of Anthropology, who took a poor view of Ardrey. Then had a session with Stan, arguing about early man's vegetarian versus carnivorous tendencies. Stan wants our visitors to turn Man into a carnivore; I argued that he always was. Back at the Chelsea, phoned Ike Asimov to discuss the biochemistry of turning vegetarians into carnivores.

November 21. Read Leakey's Adam's Ancestors. Getting rather desperate now, but after six hours' discussion Stan had a rather amusing idea. Our E. T.'s arrive on Earth and teach commando tactics to our pacifistic ancestors so that

they can survive and flourish. We had an entertaining time knocking this one around, but I don't think it's viable.

November 22. Called Stan and said I didn't think any of our flashback ideas were any good. He slowly talked me out of this mood, and I was feeling more cheerful when I suddenly said: "What if our E. T.'s are stranded on Earth and need the ape-men to help them?" This idea (probably not original, but what the hell) opened up whole new areas of plot which we are both exploring.

November 23. Stanley distracted by numerous consultations with his broker, and wants my advice on buying COMSAT.

December 10. Stanley calls after screening H. G. Wells' Things to Come, and says he'll never see another movie I recommend.

December 21. Much of afternoon spent by Stanley planning his Academy Award campaign for Dr. Strangelove. I get back to the Chelsea to find a note from Allen Ginsberg asking me to join him and William Burroughs at the bar downstairs. Do so thankfully in search of inspiration.

December 24. Slowly tinkered with the final pages, so I can have them as a Christmas present for Stanley.

December 25. Stanley delighted with the last chapters, and convinced that we've extended the range of science fiction. He's astonished and delighted because Bosley Crowther of the New York Times has placed Dr. S on the 'Ten Best Films" list, after attacking it ferociously all year. I christen Bosley "The Critic Who Came In from the Cold."

From these notes, it would appear that by Christmas 1964, the novel was essentially complete, and that thereafter it would be a fairly straightforward matter to develop the screenplay. We were, indeed, under that delusion-at least, I was. In reality, all that we had was merely a rough draft of the first two-thirds of the book, stopping at the most exciting point. We had managed to get Bowman into the Star Gate, but didn't know what would happen next, except in the most general way. Nevertheless, the existing manuscript, together with his own salesmanship, allowed Stanley to set up the deal with MGM and Cinerama, and "Journey Beyond the Stars" was announced with a flourish of trumpets.

Through the spring of 1965, we continued to revise and extend the novel, and threw away-again and yet again- whole sections which we had once imagined to be final and complete. All this time, Stanley was also hiring staff, checking designs, negotiating with actors and technicians, and coping with the millions of other problems which arise in the production of even the most straightforward movie. The rush of events became far too hectic to enter more than a small fraction of them in my log, and few of them (luckily) concerned me directly. My primary job was still polishing the novel, though I was constantly involved in technical discussions with the artists and production staff. (Sometimes with disastrous results; see entry for November 10, below.)

February 9, 1965. Caught Dali on TV, painting in a Fifth Avenue store window to promote Fantastic Voyage. Reported this to Stanley, who replied: "Don't worry- we've already reserved a window for you."

March 8. Fighting hard to stop Stan from bringing Dr. Poole back from the dead. I'm afraid his obsession with immortality has overcome his artistic instincts.

April 6. To COMSAT Headquarters, Washington, for launch of first commercial communications satellite, Early Bird." Introduced to Vice-President Humphrey, who is also Chairman of the Space Council, and told him we were spending ten million dollars to publicize space. Added that one character in the movie would be the Chairman of the Space Council . . . thirty years from now. "Oh," said H. H. H. at once, "I still intend to be chairman then."

April 12. Much excitement when Stanley phones to say that the Russians claim to have detected radio signals from space. Rang Walter Sullivan at the New York Times and got the real story-merely fluctuations in Quasar CTA 102.

April 14. Reception at Harcourt, Brace and World. Those present included Bill Jovanovich (president), Jeremy Bernstein (New Yorker Magazine), Dennis Flanagan (Scientific American), Dr. Robert Jastrow (Goddard Space Center), Stanley and Christiane Kubrick, Al Rosenfeld (Science Editor, Life), Sylvester (Pat) Weaver, Scott Meredith and many other friends. There was a general belief that the party was to celebrate Harcourt's publication of Journey Beyond the Stars, but I explained that this was not definite, and depended upon the size of the mortgage they could raise on the building.

April 19. Went up to the office with about three thousand words Stanley hasn't read. The place is really humming now-about ten people working there, including two production staff from England. The walls are getting covered with impressive pictures and I already feel quite a minor cog in the works.

Some psychotic who insists that Stanley must hire him has been sitting on a park bench outside the office for a couple of weeks, and occasionally comes to the building. In self-defense, Stan has secreted a large hunting knife in his briefcase.

May 1. Found that a fire had broken out on the third floor of the Chelsea. Waited anxiously in the lobby while the firemen dealt with it . . . visions of the only complete copy of the MS going up in smoke....

May 2. Completed the Universe" chapter-will soon have all Part Three ready for typing, hurrah.... Stan phoned to say he liked the "Floating Island" sequence. Strange and encouraging how much of the material I thought I'd abandoned fits in perfectly after all.

May 3. Finished first draft of the runaway antenna sequence.

May 25. Now Stanley wants to incorporate the Devil theme from Childhood's End....

June 7. Bad book review in Tribune-says I should stick to science exposition and am an amateur at fiction.

Late June. Read Victor Lyndon's production notes; they left me completely overwhelmed. Glad that's not my job. One scene calls for four trained warthogs.

On that note, more or less, I returned to Ceylon after an absence of over a year, and subsequently rejoined Stanley at the MGM studios at Boreham Wood, fifteen miles north of London, in August. His empire had now expanded vastly, the art department was in full swing, and impressive sets were being constructed. My time was now equally divided between the apparently never-ending

chore of developing ideas with Stanley, polishing the novel, and almost daily consultations at the studio.

August 25. Suddenly realized how the novel should end, with Bowman standing beside the alien ship.

September 25. Visitors from NASA-Dr. George Mueller, Associate Administrator, and "Deke" Slayton (Director of Flight Crew Operations). Gave them the Grand Tour- they were quite impressed. George made several useful suggestions and asked wistfully if he could have the model of Discovery for his office when we'd finished with it. Deke was later reported to have said: "Stanley, I'm afraid you've been conned by a used capsule salesman." An improbable story-I suspect the fine Italian hand of Roger Caras, Stanley's vice-president i/c promotion.

October 1. Stanley phoned with another ending. I find I left his treatment at his house last night-unconscious rejection?

October 3. Stanley on phone, worried about ending . . . gave him my latest ideas, and one of them suddenly clicked-Bowman will regress to infancy, and we'll see him at the end as a baby in orbit. Stanley called again later, still very enthusiastic. Hope this isn't a false optimism: I feel cautiously encouraged myself.

October 5. Back to brood over the novel. Suddenly (I think) found a logical reason why Bowman should appear at the end as a baby. It's his image of himself at this stage of his development. And perhaps the Cosmic Consciousness has a sense of humor. Phoned these ideas to Stan, who wasn't too impressed, but I'm happy now.

October 15. Stan has decided to kill off all the crew of Discovery and leave Bowman only. Drastic, but it seems right. After all, Odysseus was the sole survivor....

October 17. For the first time, saw Stan reduced to helpless hysterics as we developed comic ideas. There will be no one in the hibernacula-all the trainees chickened out, but the mission had to go ahead regardless.

October 19. Collected by studio car, and spent all day working (or trying to work) with Stan. Despite usual crowds of people getting at him, long phone calls to Hollywood, and a "work-to- rule" the unions called, got a lot done and solved (again!) our main plot problems.

October 26. Had a discussion with Stanley over his latest idea-that Discovery should be nuclear- pulse-driven. Read a recently declassified report on this and was quite impressed-but the design staff rather upset.

November 10. Accompanied Stan and the design staff into the Earth-orbit ship and happened to remark that the cockpit looked like a Chinese restaurant. Stan said that killed it instantly for him and called for revisions. Must keep away from the Art Department for a few days.

November 16. Long session with Stanley discussing script. Several good ideas, but I rather wish we didn't have any more.

November 18. Feeling rather stale-went into London and saw Carol Reed's film about Michelangelo, The Agony and the Ecstasy. One line particularly struck

me-the use of the phrase "God made Man in His own image." This, after all, is the theme of our movie.

November 30. To the Oxford and Cambridge Club with Roger Caras and Fred Ordway (Technical Adviser) to meet Dr. Louis Leakey and his son Richard. Dr. Leakey is just as I imagined him-full of enthusiasm and ideas. He thinks that Man now goes back at least four to five million years. He also confided to me that he'd written a play-a fantasy about primitive man which he thought would make a fine movie. It's about a group of anthropologists who are sent back into the past by a witch doctor. I said (breaking all my rules) that I'd be glad to see the MS-which is true.

December 16. My 48th birthday-and Somerset Maugham dies. Trying to make something of this (last of the competition?).

December 25. Christmas Day, ha-ha! Hacked my way to Jupiter-slow but steady going.

December 26. Working all day. Stan phoned to thank me for the presents and sent a driver to collect what I'd written. He called later to say that he didn't think much of the dialogue. I agreed.

That Christmas of 1965 we were really under the gun, and no one had a holiday. Stanley was up against an unbreakable deadline. The enormous set of the TMA 1 excavation, containing the monolith found on the Moon, had been constructed at the Shepperton Studios, in South West London-and it had to be torn down by the first week of the New Year, so that another production could move in. Stanley had only a week to do all his shooting, for the second crucial encounter between Man and Monolith.

It was not until several years later that I remembered another association between Shepperton and space. If you turn to H. G. Wells' masterpiece The War of the Worlds you will discover Chapter 12:-"What I saw of the Destruction of Weybridge and Shepperton." This first of all descriptions of armored warfare is still quite terrifying to read:

The decapitated colossus reeled like a drunken giant; but it did not fall over. It recovered its balance by a miracle, and, no longer heeding its steps and with the camera that fired the Heat-Ray now rigidly upheld, it reeled swiftly upon Shepperton. The living intelligence-the Martian within the hood, was slain and splashed to the four winds of heaven, and the thing was now but a mere intricate device of metal whirling to destruction. It drove along in a straight line, incapable of guidance. It struck the tower of Shepperton Church, smashing it down as the impact of a battering ram might have done, swerved aside, blundered on, and collapsed with tremendous force into the river out of my sight.

A violent explosion shook the air, and a spout of water, steam, mud and shattered metal shot far up into the sky. As the camera of the Heat-Ray hit the water, the latter had immediately flashed into steam. In another moment a huge wave, like a muddy tidal bore but almost scaldingly hot, came sweeping round the bend....

Of course, now we have the heat ray, and we can do a lot better than Wells' feeble Martians with a small tactical atomic bomb. Still, it's not at all bad-for 1898....

MONOLITHS AND MANUSCRIPTS

I still have the call sheet for that first day's work at Shepperton on a freezing December 29, 1965. For sentimental reasons-and because it is surely of interest even to the benighted inhabitants of that limbo once called (by one of Hollywood's lady dragons) the "non-celluloid world"-I would like to reproduce it here. There are few better ways of conveying the behind-the- scenes work that went into every frame of the movie.

My diary records that first day in some detail:

December 29, 1965. The TMA 1 set is huge-the stage is the second largest in Europe, and very impressive. A 150 x 50 x 20-foot hole, with equipment scattered around it. (E.g. neat little electric-powered excavators, bulldozers, etc. which could really work on the Moon!) About a hundred technicians were milling around. I spent some time with Stanley, reworking the script-in fact we continued through lunch together. I also met the actors, and felt quite the proper expert when they started asking me astronomical questions. I stayed until 4 p.m.-no actual shooting by then, but they were getting near it. The spacesuits, back-packs, etc. are beautifully done, and TMA 1 is quite impressive-though someone had smeared the black finish and Stanley went on a rampage when I pointed it out to him.

The jet-black slab of the monolith was, of course, an extraordinarily difficult object to light and photograph- and the scene would certainly have been wrecked if naked fingerprints had appeared on the ebon surface, even before it had been touched by the gloved hands of the astronauts. (Five years later, in the Smithsonian, I was able to flex my own fingers inside the very glove which had first made contact with the surface of the Moon.)

The famous monolith, which has caused so much controversy and bafflement, was itself the end product of a considerable evolution. In the beginning, the alien artifact had been a black tetrahedron-the simplest and most fundamental of all regular solids, formed of four equal triangles. It was a shape which inspired all sorts of philosophical and scientific speculations (Kepler's cosmography, the carbon atom, Buckminster Fuller's geodesic structures . . .), and the art department constructed models of various sizes which were set in African and lunar landscapes. But somehow, they never looked right, and there was also the danger that they would arouse wholly irrelevant associations with the pyramids.

For a while, Stanley considered using a transparent cube, but it proved impossible to make one of the required size. So he settled on the rectangular shape, and obtained a three-ton block of lucite-the largest ever cast. Unfortunately, that also looked unconvincing, so it was banished to a corner of the studio and a completely black slab of the same dimensions wag substituted. I frantically followed-and occasionally anticipated-all these changes on my typewriter, but must admit that I had a considerably easier job than the Props Department.

Despite such problems as birds (or were they bats?) invading the gigantic stage and flying across the lunar landscape, Stanley completed shooting before the one week deadline. The monolith was carefully wrapped in cotton wool, and stored in a safe place until it would be needed again-a year or so later, for the confrontation in the final hotel-room sequence. The unit went back to the Borehamwood studios, and I continued to beat out my brains....

January 7, 1966. Realized last night that the Star Gate had to be Iapetus with its six-to-one brightness ratio. Got off a memo to Stan about that.

January 8. Record day-three thousand words, including some of the most exciting in the book. I got quite scared when the computer started going nuts, being alone in the house with my electric typewriter....

January 14. Completed the Inferno chapter and have got Bowman into the hotel room. Now to get him out of it.

January 16. Long talk with Stan and managed to resolve most of the outstanding plot points. Got straight to work and by the time I staggered to bed stupefied had at last almost completed the first draft of the final sequence. Now I really feel the end's in sight-but I've felt that twice before.

January 17. About midday got a first draft of the last chapters completed. Have had a headache ever since and my brain's still spinning around. Too exhausted to feel much pleasure-only relief. Trying to unwind all day; luckily I'm off to the studio tomorrow, which will be a break.

January 18. Lord Snowdon on the set, shooting Stanley from all angles for Life.

January 19. Stanley phoned to say that he was very happy with the last chapters and feels that the story is now "rock-hard." Delighted, I tried to pin him down at once to agree that the existing version could be typed and sent off to our agent.

February 2. Spent all day with Stan-developed a few new ideas but of course there are endless interruptions, e.g. Gary Lockwood and Keir Dullea with makeup tests (we want them to look thirty-five-ish). I have a sore throat and incipient cold, so Stan kept me at arm's length.

February 4. Saw a screening of a demonstration film in which Stan has spliced together a few scenes to give the studio heads some idea of what's going on. He'd used Mendelssohn's Midsummer Night's Dream for the weightless scenes, and Vaughan Williams' Antarctica Symphony for the lunar sequence and the Star Gate special effects, with stunning results. I reeled out convinced that we have a masterpiece on our hands-if Stan can keep it up.

A few days after this, I escaped to Ceylon. But not for long:

March 15. Cable from Stan asking for "three minutes of poetic Clarkian narration" about HAL's breakdown. Got it off to him by express in the afternoon. [It was never used....] Also started on the (last) revision, and made good progress.

March 20. Worked hard on the novel all day, and by 9 p.m. had completed the messy final draft (what, again!).

April 2. Inserted a couple of hundred final (?) words into the MS, and tucked it away. As far as I'm concerned, it's finished.

Alas, it wasn't. A couple of days later I flew from Ceylon to Lawrence, Kansas, for the centennial celebrations of the University of Kansas. I cabled Stanley to say that I was heading back to London to make final arrangements for

the publication of the novel. He replied "Don't bother-it's not ready yet." I retorted that I was coming anyway, and did:

April 19. First full day back at studio-saw shooting in the centrifuge. A portentous spectacle, accompanied by terrifying noises and popping lamp bulbs. Stanley came in during a shooting break and himself raised the subject of publication date. On being challenged, he swore that he didn't want to hold up the novel until release of the movie. He explained that general release would not be until late in 1967 or even 1968. Even if the first showing is in April 1967 [It was actually April 1968] it will be running only in a few Cinerama houses, which will give us some more breathing space.

April 23. Drove with Roger Caras and Mike Wilson to an excellent private zoo near Nuneaton, which had all the big apes. Mike had a very hard time filming the chimps, who kept dashing around and throwing themselves at the camera I was a bit nervous of the baby gorilla, as it was inclined to nibble with most impressive teeth.... An enjoyable day, and I hope ifs given me some ideas about Moon-Watcher and Co.

May 29. Soviet Air Attache visited set. He looked at all the little instruction plaques on the spaceship panels and said, with a straight face, "You realize, of course, that these should all be in Russian."

At the end of May I flew back to the United States to assist with general promotion on the movie, and did my best to placate the anxious executives of MGM when they asked, "What is Stanley up to?" I also paid my first visit to Cape Kennedy, in a very small VIP guided tour conducted by James Webb, the NASA Administrator, to watch the launch of Gemini IX. Like every visitor, I was overwhelmed by the Vehicle Assembly Building and that landgoing ship, the 3,000-ton crawler-transporter, with its maximum speed (unloaded) of two miles an hour. I recall watching Representative George Miller, Chairman of the House Committee on Astronautics, as he tried out the controls of the crawler-and warning him not to exceed the speed limit, because Chief Justice Warren was standing right behind him.

Unfortunately, the Atlas-Agena target vehicle, with which Gemini IX was supposed to rendezvous, failed to go into orbit, and so the manned launch was canceled. I admired Administrator Webb's resilience as he took this in his stride and promptly turned to Congressman Miller with the remark, "I'm afraid I'll have to go back to your committee for more money."

The next month, I was once again in London, still trying to convince Stanley that the novel was finished and the MS could go out to market. During one of my more frantic arguments, he remarked, "Things are never as bad as they seem," but I was in no mood to agree.

Stanley's attitude was that he wanted to do some more work on the manuscript, and simply didn't have time because of the overwhelming pressure at the studio. (It was overwhelming, and I was continually awed by Stanley's ability to cope with a dozen simultaneous and interlocking crises, any one of which could cost half a million dollars. No wonder he is fascinated by Napoleon....) But I maintained that l was the writer and he should rely on my judgment; what would he say if I wanted to edit the film?

In the end we decided on a compromise--Stanley's. He would attempt, during odd moments in the bathroom, or while being ferried home in his Rolls-Royce at the maximum permitted speed of 30 m.p.h., to note down the improvements he

wanted me to make. On this basis, Scott Meredith was finally able to draw up an excellent contract with Delacorte Press.

Stanley was as good as his word. I still have a nine-page memorandum of thirty-seven paragraphs, dated June 18, 1966, containing some very acute, and occasionally acerbic, observations:

1. Can you use the word "veldt" in a drought-stricken area?

6. Where do you find bees in a drought-stricken area? What do the bees live on?

9. Do leopards growl?

11. Can a leopard carry a man?

14. Since the book will be coming out before the picture [sic!] I don't see why we shouldn't put something in the book that would be preferable if it were achievable in the film. I wish the block had been crystal-clear but it was impossible to make. I would like to have the block black in the novel.

15. I don't think the verb "twittering" seems right. We must decide how these fellows talk.

19. This reference sounds a little bit like a scene from Bambi.

22. The literal description of these tests seems completely wrong to me. It takes away all the magic.

24. This scene has always seemed unreal to me and somewhat inconceivable. They will be saved from starvation but they will never become gorged, sleek glossy-pelted, and content. This has barely happened in 1966. I think that one day the cube should disappear and that Moon- Watcher and his boys passing a large elephant's skeleton which they have seen many times before on the way to forage are suddenly drawn to these bones and begin moving them and swinging them, and that this whole scene is given some magical enchantment both in the writing and then ultimately in the filming, and that from this scene they approach the grazing animals which they usually share fodder with and kill one, etc.

27. I don't understand the meaning of this.

33. I prefer the previous version.... The expression "moons waxed and waned" seems terribly cliche. The expression "toothless thirty-year-olds died" also is a bit awful.

37. I think this is a very bad chapter and should not be in the book. It is pedantic, undramatic and destroys the beautiful transition from man-ape to 2001.

Lest these extracts give a false impression, I should also add that the memorandum contained several highly flattering comments which modesty has forced me to omit. In fact, Stanley sometimes overdid this. He would build up my morale (which often needed it) by unstinted praise of some piece of writing I'd just produced, then, in the course of the next few days, he would find more and more flaws until the whole thing was slowly whittled away. This was all part of his ceaseless search for perfection, which often provoked me to remind him of the aphorism, "No work of art is ever finished, it is only abandoned."

I am afraid I was prepared to abandon ship before he was; but I admired him for his tenacity, even when I wished it was not focused upon me.

Matters came to a climax in the summer of 1966, and I find this pathetic entry in my log:

July 19. Almost all memory of the weeks of work at the Hotel Chelsea seems to have been obliterated, and there are versions of the book that I can hardly remember. I've lost count (fortunately) of the revisions and blind alleys. It's all rather depressing-I only hope the ultimate result ii worth it.

The reason for this gloom was understandable. Stanley had refused to sign the contract-after Delacorte had set the book in type and taken an impressive two-page advertisement in Publisher's Weekly. He still argued that he wasn't satisfied with the manuscript and wanted to do some more work on it. I considered writing to Dr. Leakey to get the name of a good witchdoctor, and Scott Meredith bought some pins and wax. Delacorte and Co., fighting back corporate tears, broke up the type. I have always felt extremely grateful to them for their forbearance in this difficult matter, and am happy to have given them a modest best seller in Time Probe.

It was just as well that no one dreamed that another two years would pass before the book was finally published, by New American Library in the summer of 1968 -months after the release of the movie. In the long run, everything came out all right-exactly as Stanley had predicted.

But I can think of easier ways of earning a living.

THE DAWN OF MAN

During November 1950 I wrote a short story about a meeting in the remote past between visitors from space and a primitive ape-man. An editor at Ballantine Books gave it the ingenious title "Expedition to Earth" when it was published in the book of that name, but I prefer "Encounter in the Dawn." However, when Harcourt, Brace and World brought out my own selection of favorites, The Nine Billion Names of God, it was mysteriously changed to "Encounter at Dawn." There the matter rests at present.

Though "Encounter" was not one of the half-dozen stories originally purchased by Stanley, it greatly influenced my thinking during the early stages of our enterprise. At that time-and indeed until very much later-we assumed that we would actually show some type of extraterrestrial entity, probably not too far from the human pattern. Even this presented frightful problems of makeup and credibility.

The make-up problems could be solved-as Stuart Freeborn later showed with his brilliant work on the ape-men. (To my fury, at the 1969 Academy Awards a special Oscar was presented for make-up to Planet of the Apes! I wondered, as loudly as possible, whether the judges had passed over 2001 because they thought we used real apes.) The problem of credibility might be much greater, for there was danger that the result might look like yet another monster movie. After a great deal of experimenting the whole issue was sidestepped, both in the movie and the novel, and there is no doubt that this was the correct solution.

But before we arrived at it, it seemed reasonable to show an actual meeting between ape-men and aliens, and to give far more details of that encounter in

the Pleistocene, three million years ago. The chapters that follow were our first straightforward attempt to show how apemen might be trained, with patience, to improve their way of life.

It was part of Stanley's genius that he spotted what was missing in this approach. It was too simpleminded; worse than that, it lacked the magic he was seeking, as he explained in item 24 of his memorandum, quoted earlier.

In the novel, we were finally able to get the effect we wanted by cutting out the details and introducing the super-teaching machine, the monolith-which, even more important, provided the essential linking theme between the different sections of the story. In the film, Stanley was able to produce a far more intense emotional effect by the brilliant use of slow-motion photography, extreme closeups, and Richard Strauss's Zarathustra. That frozen moment at the beginning of history, when Moon-Watcher, foreshadowing Cain, first picks up the bone and studies it thoughtfully, before waving it to and fro with mounting excitement, never fails to bring tears to my eyes.

And it hit me hardest of all when I was sitting behind U Thant and Dr. Ralph Bunche in the Dag Hammarskjold Theater, watching a screening which we had arranged at the Secretary General's request. This, I suddenly realized, is where all the trouble started-and this very building is where we are trying to stop it. Simultaneously, I was struck by the astonishing parallel between the shape of the monolith and the UN Headquarters itself; there seemed something quite uncanny about the coincidence. If it is one....

The skull-smashing sequence was the only scene not filmed in the studio; it was shot in a field, a couple of hundred yards away-the only time Stanley went on location. A small platform had been set up, and MoonWatcher (Dan Richter) was sitting on this, surrounded by bones. Cars and buses were going by at the end of the field, but as this was a low-angle shot against the sky they didn't get in the way-though Stanley did have to pause for an occasional airplane.

The shot was repeated so many times, and Dan smashed so many bones, that I was afraid we were going to run out of wart-hog (or tapir) skulls. But eventually Stanley was satisfied, and as we walked back to the studio he began to throw bones up in the air. At first I thought this was sheer joi de vivre, but then he started to film them with a hand-held camera-no easy task. Once or twice, one of the large, swiftly descending bones nearly impacted on Stanley as he peered through the viewfinder; if luck had been against us the whole project might have ended then. To misquote Ardrey (page 34), "That intelligence would have perished on some forgotten Elstree field."

When he had finished filming the bones whirling against the sky, Stanley resumed the walk back to the studio; but now he had got hold of a broom, and started tossing that up into the air. Once again, I assumed this exercise was pure fun; and perhaps it was. But that was the genesis of the longest flash-forward in the history of movies-three million years, from bone club to artificial satellite, in a twenty-fourth of a second.

[At one time we had intended not a flash-forward but a flashback; I had quite forgotten this, until I noticed that the four chapters that follow were originally numbered 35 to 38. It seems more logical, and certainly less confusing, to reproduce them here, so giving this book the same structure as the novel-and the movie.]

FIRST ENCOUNTER

The glaciers had retreated now, and the shapes of the continents were much as Man would know them, when he made his first maps three millions years hence. There were, of course, minor differences, the British Isles still formed part of Europe, and the causeway between Asia and America had not yet crumbled into the islands of the Bering Strait. And the Mediterranean valley was still unflooded; the Pillars of Hercules would stand fast for ages yet, before the ocean broke through and the false, sweet legend of Atlantis was born.

And just what creatures will this world hold? asked Clindar as he looked down upon the turning globe. The great ship had come through the Star Gate only a few hours before, and the excitement of planetfall was still upon all its crew. Every world was a new challenge, a new problem, with its endless possibilities of life and death- and its hope of companionship in this still achingly empty universe.

In the five centuries since he had left Eos, Clindar had walked on thirty worlds, and devoted at least ten years of his life to each. On two he had suffered minor deaths, but this was one of the inevitable hazards of exploration. He expected to die many times again before he returned to his native world, now a thousand light-years away in normal space. As long as his body was not totally destroyed, the doctors could always repair it.

Apart from their unusual height-more than seven feet- the creatures looking down upon the world of the Pliocene were strikingly human; far more human, indeed, than anything that yet walked on the planet below. Only if one examined them in detail was it obvious that they belonged to an entirely different evolutionary tree; Nature had rung the changes once again on one of her favorite designs.

There are millions of two-armed, upright, biped races in the universe. Thousands of them, on a dark night or in a thick fog, might be mistaken for human beings. But there are only a few hundred species who could mingle undetected in the society of man-and none at all that could pass even the most superficial medical examination.

With a little plastic surgery, Clindar could have passed as a man. He was hairless, and there were no nails on his six fingers and toes; these stigmata of the primitive jungle his race had lost eons ago. Despite his size, he moved swiftly, with a jerky, almost avian walk and rhythm. He thought and spoke more quickly than any man would ever do, and his normal body temperature was almost 105 degrees. His skeleton and his biochemistry were utterly inhuman, and any cannibals foolish enough to feast upon his flesh would surely die. Yet despite all this, one would have to search a million worlds to find a closer approximation to a man.

And, like Man, he and his companions were insatiably inquisitive. Now that they had the power to explore the universe, they would enjoy it to the full.

The maps, the photographic surveys, the spectrochemical analyses, were all completed. After a year in orbit, it was time to land. Like a stick of bombs, ten glittering spheres were ejected from the thousand-foot-long mother ship, and fell toward the cloud-wrapped globe below.

They drifted apart, spread themselves out along the equator, and settled gently on mountain, plain, and swamp. Clindar and his two companions floated for miles across the jungles before they saw a good landing place; then the sphere

extended its three telescopic legs and came to rest as delicately as a falling soap bubble, upon the land that would one day be named Africa.

For a moment no one spoke; each wanted to savor this moment in silence. The three of them, as was usually the case on such expeditions, were all members of the same mating group, so neither their bodies nor their minds held any secrets from each other. This was their fifth landing together, and silence united them more closely than any words.

At last, Clindar touched the control panel, and into the cabin came the sounds of the new world. For a long time they listened to the voices of the forest, to the sighing of the wind through the strange trees and grasses, to the cries of animals killing or being killed-and a changeless background of muted thunder, the roar of the great waterfall two miles away. One day they would know every thread in this tapestry of sound; but now it was full of menace, and woke forgotten fears. For all their wisdom and sophistication, they felt like children facing the unknown terrors of the night; and their hearts ached for home.

The familiar routines of the landing procedure soon turned them back into calm, professional explorer scientists. First the little collection robots were sent rolling in all directions, to gather leaves and grasses and, with luck, any small animals slow-moving enough to be caught. All the samples they brought back were examined in the scoutship's sealed and automatic lab, so that there was no danger of contamination. The biochemical patterns were swiftly evaluated-it was rare to find a wholly novel one, especially on an oxygen-carbon world like this-and the information flashed up to the hovering mother ship, twenty thousand miles away. There seemed to be no virulently hostile microorganisms here, but life was of such infinite complexity that one could never be sure. Planets could produce deadly surprises, generations after they had been declared completely safe.

No large animals came near the ship during the hours of daylight which was not surprising, for it stood in several acres of open ground where the only cover was a few low bushes. But at dusk, the picture changed, and the land became alive as the shadows lengthened and deepened into night.

To the watchers on the ship, darkness was no handicap. Through the infrared periscope they could see the world around them as if it were still daylight; they could follow the shy herbivores on their way to the waterholes, and could study the tactics of the great predators who hunted them. There were still tigers in this land, with twin sabers jutting from their jaws; but in another million years they would be gone, and Africa would belong to the lion.

It was slow, sometimes exasperating, but always fascinating work-making a census of a world one could not touch. Several times Clindar moved the ship a few miles to change the vantagepoint, and to make sure that the animals and plants formed a representative sample. And in the second week, they found the hominids. It was the din through the long-distance microphones that drew attention to them. As Clindar swung the periscope in the direction of the uproar, he found that his view of the disturbance was partly blocked by trees, but he could see enough to make it unnecessary to move the ship.

About half a mile away, in a small clearing near the bank of an almost dried-up river, a leopard had made a kill. It was crouched over some unfortunate victim who had presumably been drinking at the water's edge, and was snarling angrily at a hostile chorus from the surrounding trees. There were dark, shadow

animals of fair size moving through the branches of those trees, and it was some time before Clindar could get a good view of one. But suddenly, as he tracked through the foliage, he came upon a clear line of sight-and looked straight into a hairy caricature of his own face.

The creature was screaming with rage as it danced up and down on the tree limb, directing its fury at the leopard. On other branches, its companions were doing the same, and though they could not harm the killer they were obviously annoying it, for presently the big cat started to move away, dragging the bloody carcass of its victim by the leg. As the body rolled over, Clindar found himself once again looking into the distorting mirror of time.

He had seen the reconstructions of his own ancestors, five or ten million years ago; the mask now stiffening into a grimace of death might have belonged to any one of them. There was the same low, ridged forehead, close-set eyes, muscular but chinless jaw, protruding teeth. It was not the first time he had met this pattern, for variations of it were common on many worlds, yet it always filled him with wonder, and with a sense of kinship that spanned the evolutionary gulfs.

The leopard and its victim vanished from view; the chorus of fear and anger died away. Clindar watched, and waited.

Slowly and cautiously, the hominids came down from the trees, in which they did not seem to be completely at home. They walked on all fours, but from time to time reared up on their hind limbs and took several steps in an upright position. Abruptly, as if they had spotted the leopard again, they all fled in panic, away from the river and the trees. As they ran, they became true bipeds, covering considerable distances without their forelimbs touching the ground.

Clindar followed them with some difficulty, and at first thought he had lost them. Then he spotted their brown figures swarming up the almost vertical face of a sandstone cliff, heading for a cave some fifty feet from the ground. It was a well-chosen refuge, for the entrance was too high to be reached by the great cats. Such a choice of dwelling place might be instinctive, but it might also indicate the dawn of intelligence. These creatures, Clindar told himself with mounting excitement, would certainly merit watching.

Through long but fascinating hours at the periscope, he grew to know them all, and to learn the pattern of their behavior. There were only ten of them-four males, three females, three infants-and physically they were unimpressive specimens, living always on the edge of hunger. Most of their food was obtained by foraging among grasses and shrubs, but they were not exclusively vegetarian. They ate meat whenever they could get it, which was seldom, for they were inefficient hunters. About the only animals that fell prey to them were tortoises, small rodents, and occasional fish that they could catch in the shallows of the river.

Because they did not possess the simplest tools, they could not even take proper advantage of such rare and accidental windfalls as a mired elephant, or an antelope that had broken its leg. The meat would rot before they could tear it all out with their teeth; and they could not fight off the big carnivores that would be attracted to such a feast.

It was a wonder that they had survived, and their future did not look promising. Clindar was not in the least surprised when one of the infants died, apparently of starvation, and the little body was thrown out of the cave for the

hyenas to carry away. These creatures had not yet learned the useful accomplishment of burying their dead, lest they lead wild animals to the living.

But Clindar, with the experience of many worlds behind him, knew that appearances could be deceptive. These unprepossessing near-apes had one great advantage over all the other creatures of their planet. They were still unspecialized; they had not yet become trapped in any evolutionary cul-de-sac. Almost every animal could beat them in some respect-in strength, or speed, or hearing, or natural armament. There was no single skill in which the hominids excelled, but they could do everything after a fashion. Where the other animals had become virtuosos, they had specialized in a universal mediocrity-and therein, a million years hence, might lie their salvation. Having failed to adapt themselves to their environment, they might yet one day change it to suit their own desires.

Other humanoid races, times without number, had taken a different road. Clindar had seen, either with his own eyes or through the records of other explorers, those who had chosen to specialize-though the choice, of course, was never a conscious one. He had seen near-men who could run like the wind, swim like fish, hunt in the dark with sonar or infrared senses; on one world of exceptionally low gravity he had even encountered men who could fly. Most of these specialists had been extremely successful; so successful that they had had no need to develop more than a rudimentary intelligence.

And therefore they were doomed, though they might flourish for a million years. Sooner or later, the environment to which they were so perfectly adapted would change, and they could not change with it. They were too far from the crucial fork in the evolutionary road ever to retrace their steps.

On this world, the choice remained; the irrevocable decision between brain and body had not yet been made. The future was still in the balance. Here, on this tropical plain, the balance might be tipped-in favor of intelligence.

MOON-WATCHER

It was surprising how quickly all the animals grew accustomed to the ship; because it did nothing, and merely stood motionless on its tripod of legs, they soon came to regard it as part of the landscape. In the heat of noon, lions would shelter beneath it, and sometimes elephants and dinotheria would rub their thick hides against the landing gear. Clindar preferred to choose a moment when none of the larger or more dangerous beasts were around when he made his first exit

From the underbelly of the ship a transparent, cylindrical tube ten feet in diameter lowered itself until it had reached ground level, down this, in an equally transparent cage, rode Clindar and his equipment. The curving walls slid open, and he stepped out onto the new world.

He was insulated from it, as completely as if he were still inside the ship, but the flexible suit that surrounded him from head to foot was only a minor inconvenience. He had full freedom of movement, for there was no external vacuum to make the suit stiff and rigid. Indeed, he could even breathe the surrounding atmosphere-after it had been scrubbed and filtered and purified by the small processing pack on his chest. The air of this planet might carry lethal organisms, but it was not poisonous.

He walked slowly away from the ship, feeling his balance in this alien gravity and accustoming himself to the weight of his equipment. Besides the usual communication and recording gear, he was carrying nets, small boxes for specimens, a geologist's hammer, a compact explosive powered drill, and a coil of thin but immensely strong rope. And though he had no offensive weapons, he had some extremely effective defensive ones. The land through which he was walking seemed absolutely barren of animal life, but he knew that this was an illusion. Thousands of eyes were watching him from trees and grass and undergrowth, and as he moved slowly along one of the trails which the herbivores had beaten to the waterhole, he was also conscious that the normal patterns of sound had changed. The creatures of this world knew that something strange had come into their lives, there was a hushed expectancy about the land-a subdued excitement that communicated itself to Clindar. He did not anticipate trouble, or danger; but if it came, he was ready for it.

He had already chosen his vantage point, a large rock about a hundred yards from the watering place where the hominid had been killed. Near the summit was a cave formed by two boulders resting against each other, it would provide just the shelter and concealment he needed. Such a desirable residence was not, of course, empty, it contained several large, indignant, and undoubtedly poisonous snakes. He ignored them, since they could not harm him through the tough yet almost invisible envelope of his suit.

He set up his cameras and his directional microphones, reported back to the ship, and waited.

For the first few days he merely observed without interference. He learned the order in which the various animals came to the water, until he could predict their arrival with fair accuracy. Above all, he studied the little group of hominids, until he knew them as individuals and had christened them all with appropriate private names. There was Greypate, the oldest and most aggressive, who dominated all the others. There were Crookback and One-Hand and Broken-Fang, but the most interesting was the young adult that Clindar had called Moon-Watcher, because he had once spotted him at dusk, standing on a low rock and staring motionless into the face of the rising moon. The posture itself was unusual, for the hominids seldom stood erect for more than a few seconds at a time, but even more striking was the suggestion of conscious thought and wonder. Perhaps this was an illusion; yet Clindar doubted if any other inhabitant of this world ever stopped to stare at the moon. Nor was it, in this environment, a very sensible thing to do. Clindar was strangely relieved when the creature started to trot back toward its cave, away from the unsleeping perils of the night.

His first attempt to collect specimens was not a success. A small antelope, with graceful, corkscrew horns, had apparently become detached from the herd and was wandering along the trail to the waterhole in a rather distracted manner. Clindar got it in the sight of his narcotic gun, aimed carefully at the fleshy part of the flank, and squeezed the trigger. With barely a sound, the dart whispered to its target.

The antelope started, though no more violently than if a mosquito had bitten it. For a moment there was no other reaction-but the biochemists had done their work well. The animal walked three or four paces, and then collapsed in a heap.

Clindar hurried out of the cave to collect his victim. He was halfway down the sloping rockface when there was a flash of yellow, and almost before he had

realized what had happened, the antelope was gone. A passing leopard had outsmarted an intelligence that could span the Galaxy.

Some hunters would have cursed; Clindar merely laughed and went back to his cave. Two hours later, he shot Moon-Watcher.

He reached the fallen hominid only seconds after the flying dart. Beneath its hairy pelt the body was well muscled but undernourished, he had no difficulty at all in lifting it and carrying it back to the ship, where a thorough examination could be made.

Moon-Watcher was still unconscious, but breathing steadily, when the elevator took him up into the ship. He slept peacefully in the sealed test chamber for many hours, while scores of instruments measured his reactions and beams of radiation scanned the interior of his body as if it had been made of glass. His head was shaved, with considerable difficulty, for the hair was a matted and well-populated tangle, and electrodes were attached to his scalp. In the mother ship, thousands of miles above the earth, the great computers probed and analyzed the patterns of cerebral activity, so much simpler than their own; and presently they delivered their verdict.

When it was all finished, Clindar carried Moon Watcher back to the elevator and down to ground level. He left him still unconscious, propped up against one of the landing legs, and guarded him from the ship until he had come to his senses. He would have done the same with any other animal; centuries of traveling through the empty wastes of the universe had given him an intense reverence for life in all its forms. Though he never hesitated to kill when it was necessary, he always did so with reluctance.

Presently Moon-Watcher stirred drowsily, scratched his newly bared scalp with obvious astonishment, and staggered to his feet. He proceeded for a few yards in a wavering line, then became aware of the ship looming above him, and stopped to examine it. Perhaps he thought it was some peculiar kind of rock, for he showed no signs of alarm. After a few minutes, now much steadier, he set off briskly in the direction of his cave, and soon disappeared from view.

When the intelligence profiles and brain-capacity assessments came down from the mother ship, Clindar brooded over them for a long time, discussed them with his colleagues, and asked the computers far overhead for their extrapolations into the future. There was potential here- several billion brain cells, as yet only loosely interconnected. Whether that potential could ever be realized depended on time and luck. Time could not be hurried; but luck was not altogether beyond the power of intelligent control.

Here was a situation common in the history of stellar exploration, though it was new to Clindar himself. Often the ships of his people had arrived at a world where some creature was at the watershed between instinct and conscious thought, and in the early days there had been much debate about the appropriate action. Some argued that it was better to stand aside and to leave the ultimate decision to chance and nature; but when this was done, the result was almost always the same. The universe was as indifferent to intelligence as it was to life, left to themselves, the dawning minds had less than one chance in a hundred of survival. Most of them achieved no more than a tragic consciousness of their own doom, before they were swept into oblivion.

In these circumstances, the choice was clear-though not all races would have been sufficiently unselfish to make it. When an emerging species could be

helped, aid was given. But too much assistance could also be fatal, and it was necessary to aim for a minimum of interference, lest the rising culture become no more than a distorted echo of an alien society.

For in the long run a species, like an individual, had to stand on its own feet, and find its own destiny. Clindar was very well aware of this, as he studied the hominids and prepared to play God.

There had been a heavy rainstorm, and the world around him was tantalizingly fresh and sparkling beyond the impermeable barrier of his suit. On such a morning, it seemed a crime to kill, nor was there any exoneration in the knowledge that thousands of hidden deaths were occurring every minute in this shining land.

The hunter from the stars stood at the edge of the Savannah, choosing his victim. Out to the horizon he could see uncountable numbers of gazelles and antelopes and wildebeest and zebras-or creatures whose descendants would one day bear these names-browsing on the sea of grass. He raised his weapon to his shoulder, aimed through it like a telescope, and pressed the firing stud. There was a flicker of light, barely visible in the fierce glare of the African sun, and a young gazelle dropped so swiftly and silently that none of its companions took the slightest notice. Even when Clindar walked out to collect the body-unmarked except for the charred hole above the heart-they trotted only a few yards away and regarded him with only mild alarm.

He threw the gazelle over his shoulder and set off at a brisk walk toward the cave of the hominids. Before he had gone three hundred yards he realized, with some amusement, that he was being stalked by a saber-toothed tiger that had emerged from the undergrowth at the edge of the plain.

He put down the gazelle and turned to face the great cat. When it saw that he was aware of it, the tiger growled softly and opened its jaws in a terrifying display of fangs. At the same moment, it quickened its pace.

Clindar also wasted no time. He threw a switch on his suit, and at once the air was rent by a hideous, undulating howl as of a thousand souls in torment. Out on the plain, the flocks of herbivores began to stampede, and even above the cacophony of the siren he could hear the drumming of their hooves like a distant thunder.

The tiger reared up on its haunches, slashing viciously at the empty air in its surprise. Then it dropped back to the ground and, to Clindar's utter astonishment, continued its advance. It was very brave, or very stupid, or very hungry. In any event, it was very dangerous.

Clindar whipped his projector into the firing position, and barely had time to defocus it before the tiger charged. This time there was no visible flash, for the beam fanned out over too wide an area to produce its characteristic scintillation. But when the tiger reached the ground it was already blind, for it had stared into the light of a hundred suns. Clindar had no difficulty in avoiding it as it staggered away, shaking its massive head from side to side in confusion.

It would be at least an hour before the magnificent beast's sight returned to normal; as it tottered away, Clindar hoped that it would not injure itself by crashing into any obstacles.

There were no more interruptions in his morning walk, and presently, not even winded by his exertions, he arrived at the cliff face where the hominids lived. Keeping in full view, and making as much noise as possible, he placed his offering immediately beneath the opening of the cave. Then he moved back a hundred yards, sat down, and waited with the patience of a being who had already seen a thousand birthdays and could, if he wished, see endless thousands more.

There must, he knew, be many eyes watching him from the darkness of the cave, and behind those eyes would be dim brains in which fear and hunger strove together. It would be rare indeed for the hominids to encounter such a windfall as this, for the gazelles could outrun them easily and they had not yet invented any of the arts of the hunter.

It was a full hour before the oldest of the males appeared in the shadows of the opening, started outside for a few seconds and then disappeared again into the gloom. Nothing else happened for another hour or so then Clindar's friend Moon-Watcher emerged, looked around nervously, and started to descend the face of the cliff. He scuttled across to the dead gazelle, which was now surrounded by a cloud of buzzing flies, and paused here for a moment, obviously torn with agonizing indecision.

Clindar could read the creature's mind with the utmost ease. Shall I feast here, it was saying to itself, and risk being eaten myself-or shall I carry this banquet back to the safety of the cave-where I will have to share it with the others?

Moon-Watcher solved his excruciating problem by a compromise. He buried his fangs in the neck of the gazelle, and with great difficulty, tore out a hunk of bloody meat. Then he threw the corpse over his shoulder and swarmed up the rockface with quite astonishing speed.

Lesson one was over. Feeling very satisfied, Clindar went back to the ship. He did not expect that the hominids would leave the cave again that day.

Seven gazelles and two antelopes later, he had made considerable progress. When he left his present at the foot of the cliff, the whole family would emerge and quarrel over it. Their table manners left much to be desired, but they were beginning to take him for granted. Though he sat in full view, a strange and utterly alien figure in his shimmering protective envelope, they appeared quite unafraid of him. Every day he had moved a little closer, until now he sat within fifty feet of the dining place.

Before the hominids became completely dependent upon him, and forgot how to fend for themselves, he would take the next step.

GIFT FROM THE STARS

Jupiter was a brilliant star, almost vertically above him, as Clindar walked through the sleeping bush an hour before dawn. Up there, half a billion miles away, was the entrance of the Star Gate, and the road across the light-years that led to his infinitely more distant home. It was a road with many branches, most of them still unexplored and leading to destinations which were perhaps unimaginable. Down a few of those byways were the lonely civilizations scattered so sparsely throughout this arm of the galactic spiral. One day this world might be among them; but that time could not come for at least a million years.

The hominids never left their cave during the hours of darkness, but Clindar could hear them barking and quarreling sleepily as they prepared to meet the new day. He placed his bribe-a young boar-at the foot of the cliff, where they were bound to pass. This time, however, he did not withdraw. He sat down only a few feet away from the sacrifice, and waited.

The stars faded from the sky, Jupiter last of all. Presently the rays of the rising sun began to gild the face of the cliff, moving slowly downward until they shone straight into the cave. Then, from the interior, came a sudden excited chattering, and the high-pitched "EekEek" which Clindar had grown to recognize as an alarm signal. The hominids had spotted him.

He could see their hairy figures milling around in the entrance, undecided what to do next. If they did not pluck up enough courage to come down in a reasonable time, Clindar would leave. But he would take the boar with him, and hope that they would draw the conclusion that food and friendship were inseparably linked.

To his pleased surprise he did not have long to wait. Moving slowly but steadily, Moon- Watcher was descending the face of the cliff. He got to within twenty feet of ground level and then paused to survey the situation. Presumably he still felt quite confident that he was safe, and in ordinary circumstances he would have been right. Only a nimble ape, and not one of the great cats, would be able to scale this almost vertical rock.

Clindar pulled a knife from his equipment belt, and, with rather more energy than skill, started to disjoint the boar. It must, he thought, look like magic to MoonWatcher to see how swiftly the tough meat came apart; he was performing in a few seconds acts which took the hominids many minutes of tearing and biting. When he had detached a foreleg, he held it out to his fascinated spectator.

He was patient, and Moon-Watcher was hungry, but the result was not inevitable. For many minutes the creature hovered hesitantly on the face of the cliff, descending a few feet, then hastily scrambling upward again. At last it made its decision, and gathered all its courage together. Still prepared for instant flight, Moon-Watcher dropped from the face of the cliff and started to sidle towards Clindar, approaching him in a cautious, crab-wise manner. Every few steps he stood upright for a second, grimacing and showing his teeth. He was obviously trying to demonstrate that he could defend himself if the need arose.

It took him several minutes, with numerous retreats and hesitations, to cross the last few feet. While he was doing this, Clindar pretended to chew avidly at the leg of boar, holding it out invitingly from time to time.

Abruptly, it was snatched from his hand, and in seconds Moon-Watcher was halfway up the cliff, carrying his prize between his teeth. Patiently, Clindar started to slice away at the carcass once more, waiting for the next move. It came within the hour, when Moon-Watcher returned for a second helping. This time, Graypate and Broken Fang followed him part of the way down the cliff face, anxious to see how it was done.

So the experiment in primitive diplomacy continued, day after day-sometimes in the morning before the hominids had left their cave, sometimes in the evening as they returned from the day's foraging. By the end of a week, Clindar had become accepted as an honorary member of the tribe. They were completely unafraid of him, and would squat in a circle watching his actions from a few

feet away. Some of the infants would scamper over and touch him, until scolded by their mothers; but the adults still avoided direct contact. They were inquisitive, but not yet friendly.

To Clindar it was a weird, almost unreal existence, this daily switching between two worlds a million years apart. While his colleagues were probing the planet with the most advanced instruments of their science, he was mentally identifying himself with creatures who had barely reached the dawn of reason. He had to see through their eyes, remember the limitations of their clumsy fingers, imagine the slow processes of their brains when they were confronted with something new. Fortunately, there was the experience of others to guide him; when he was aboard the scoutship, he would search the records of the past, learning what earlier expeditions had done, on other worlds. He could profit from their successes, and avoid their mistakes.

Because speech still lay a million years in the future, the only way to instruct these creatures was by example. And because his people excelled in anything they turned their minds to, Clindar was soon the most efficient hunter on the planet. He was surprised, and a little disturbed, to find how much he enjoyed it. The ancient instincts had not wholly died, even though it had been a hundred thousand generations since they had last been given rein.

His favorite weapon was the thighbone of one of the larger antelopes; with its knobbly end, it formed a perfect natural club, much superior to any branch that could be wrenched off a tree. With a single well-placed blow it could kill animals up to the size of the hominids themselves, and it could drive off creatures that were far larger. Clindar was anxious to prove this, and had thought of staging a demonstration. As it turned out, his wish was granted without any deliberate planning.

The horde-it could not yet be granted the name of tribe-had now completely identified him with food, and the males were ready to follow him wherever he went. Even those females who were not burdened with infants would sometimes stop gathering leaves and fruit to accompany him, in the hope of profiting from his success.

They found the dead zebra only a few hundred yards from the scoutship, surrounded by the hyenas that had run it down. There were six of the mangy, unprepossessing scavengers worrying the carcass; confident that nothing smaller than a lion could disturb them, they continued their feasting as Clindar approached. Behind his back he could hear his pupils chattering nervously as they kept their distance.

The hyenas looked at Clindar warily, snarling and holding their ground, as he came nearer. He was the first biped they had ever seen-indeed, the only biped in all this world-but his strangeness did not alarm them. They were certain that they could protect their spoils.

A second later, they were not so sure. Clindar advanced on them like a whirlwind, a club in each hand-for he was completely ambidextrous-and started raining blows on the startled beasts. Too astonished to fight back, they fled, yelping hideously; then one of them regained his courage, spun around, and launched himself straight at Clindar's head.

That was good; it must not seem too easy, or the hominids would put too great a faith in these primitive weapons, and get themselves into disastrous

situations. They must learn that a club would not make them invincible, and that the outcome of a fight would still depend on their own skill and strength.

Nevertheless, Clindar cheated, it was not really a fair demonstration, though it served its purpose admirably. He was far more powerful and better coordinated than these clumsy ape-men, and in an emergency he could move with a speed which very few animals on this world could match. Moreover, he was completely protected by the flexible yet incredibly tough film that insulated him from the microscopic killers that teemed in air and soil. The hyena did not really have a chance.

Clindar had already moved aside as it went hurtling by him, drifting past in slow motion to his accelerated senses. He caught it one terrific blow with the club as it sailed by-misjudging his strength, because the bone splintered and snapped and he was left holding the stump in his hand. But it did not matter, the hyena was dead before it reached the ground. The others, who had turned to watch the fight and were prowling hopefully in the near distance, did not wait for a further demonstration.

During the fight, the hominids had also kept their distance, but at least they had not been scared away. Now they approached with a kind of nervous eagerness, their attention equally divided between Clindar and his victim.

Moon-Watcher, always in the forefront, reached him first. He edged over to the slain hyena, put out a cautious paw, touched the body, and quickly withdrew. Twice he repeated this, until he was convinced that the animal was really dead. Then his jaw dropped in a comical expression of astonishment, and he stared at Clindar as if he could not believe his eyes.

Clindar held out the second, unbroken dub in his right hand, and waited. This was the moment; no better one would ever come. If Moon-Watcher had not learned the lesson now, he would never do so.

The hominid came slowly toward him, then squatted down only five feet away; he had never approached so closely before. Holding his head slightly on one side in an attitude of intense concentration, he stared at the bone held rigidly in Clindar's hand. Then he reached out a paw and touched the crude club.

His fingers grasped the end, and tugged gently at it. Clindar held firm for a moment, then released his grip.

Moon-Watcher drew the bone away from him, looked at it intently, then began to sniff and nibble at it. A spasm of disappointment shot through Clindar's mind; the lesson was already forgotten. This was just another morsel of food-not a key to the future, a tool that could lead to the mastery of this world, and of many others.

Then Moon-Watcher suddenly remembered. He jumped to his feet, and began to dance around waving the club in his right paw. As long as he kept moving, he could rear almost upright; only when he stood still did he have to use his free forelimb as a support. He had already begun to make the awesome and irrevocable transition from quadruped to biped.

The little dance lasted about five seconds; then Moon-Watcher shot off on a tangent. He raced toward the dead hyena in such a frenzy of excitement that his companions, who had already started to quarrel over the feast, scattered in fright.

Awkwardly, but with an energy that made up for his lack of skill, Moon-Watcher began to pound the carcass with his club, while the others looked on with awed astonishment. Clindar alone understood what was happening, and knew that this world had come to a turning point in time. To the most promising of its creatures, he had given the first tool; and the history of yet another race had begun.

FAREWELL TO EARTH

During the next five years, as the scoutships drifted far and wide over the face of the planet gathering thousands of specimens and millions of items of information, Clindar revisited the hominids many times. He never went hunting with them again; they had learned that lesson with astonishing-indeed, with ominous-speed, and all the males now knew how to use clubs when the need arose. Instead he had tried to introduce other tools, of which the most important were stone knives and hammers.

These small hand tools, crude though they might appear at first sight, represented a gigantic leap forward in technology. They multiplied the efficiency-and therefore the chance of survival-of their users many times. With a properly shaped flint one could dig up tough roots and hack off succulent branches which would otherwise be exhausting and laborious to collect. And a small, round pebble that fitted the hand nicely could split bones to get at the marrow, or crack animal skulls to reach the tenderest and most well-protected of all meat.

One day, if all went well, the hominids would not only use tools-they would make them; and they would make them of metal and of plastic and, in the end, of pure fields of force. But how they would use those tools-whether for good or for evil-was beyond prediction, and to be revealed only by the passing of the ages.

They had been given their initial impetus, and that was all that one could, or should, do for a species at this level of intelligence; the rest was up to them. The outcome might yet be disastrous, as it had often been in the past. Failures could not be avoided, but they could be expunged; if one world was lost, there were many others. For Clindar's race, driven by impulses long buried in their own infancy, were gardeners in the field of stars. They sowed, and often they reaped. But sometimes they had to weed.

For the last time, Clindar stood on the African plain, brooding over his experiment with destiny. Above him loomed the globe of the scoutship, already throbbing with the energies that would soon carry him up to the lonely heights of space. And on his shoulder, completely unafraid, sat one of the little ape-children, searching hopefully for lice and salt crystals in the folds of his outer clothing. Clindar had long since been able to discard his protective envelope; he was now immune to the micro-fauna of this world, and carried nothing in his own body that could destroy the life around him.

A few yards away, the mother hominid was plucking berries; she had ignored her child completely, as if quite confident that it was in safe hands. She could never guess. thought Clindar, how much this little creature's chances of survival had improved. The tribe had prospered, thanks to the tools and weapons he had given it; no longer was it starving and defenseless. Even the big cats had begun to avoid these animals whose forelimbs, though they had no claws, could inflict such stinging pain.

A series of musical notes sounded from the communicator at Clindar's waist; his friends were growing impatient. He could not blame them; all these years they had remained insulated from this world, while he took the risks- and the rewards. Their turn would come later, on other planets, while he watched the instruments and recorders from the safety of the ship. Where was Moon- Watcher? Not far away, he was sure. He gave the three piercing whistles that the hominid had learned to recognize as his signal, and waited.

A few minutes later, there was a rustling in the undergrowth, and Moon-Watcher emerged, carrying a small gazelle over his shoulder. He grimaced and chittered with pleasure at the sight of his friend, and started to lope toward him with the awkward but swift three-limbed gait he employed when one of his forepaws was holding something.

In the last five years Moon-Watcher had matured and aged a good deal, and was now nearing the-doubtless violent-end of his short life. But he was in good condition, with only a few bald patches on his chest and thighs and he was well fed. He had lost his left ear in a fight with a hyena a few months ago, and that in itself was a sign of progress. None of his ancestors would have dreamed of competing with the snarling scavengers of the plains.

Still carrying the infant on his shoulder, Clindar moved out from the shadow of the ship to meet his friend. Perhaps the baby was Moon-Watcher's; there was no way of telling, for mating among the hominids was completely promiscuous and stable family relations were still ages in the future. The infants were indiscriminately mothered by all the females, and cuffed out of the way by all the males.

This open place would do well enough. Clindar reached out his hand toward Moon-Watcher, and waited. In the early days the hominid had avoided all contact, especially when he was carrying food, but now he was no longer in the least shy. Trustingly, he held out his free hand toward Clindar, and for the last time they touched across the gulfs that sundered them.

Clindar tugged the hairy paw upward, so that MoonWatcher stood teetering on his hind legs. in the position his remote descendants must one day assume if they were ever to free their hands and their minds. He turned his face toward the ship, and gave the slight twist of the head that signified "now." The brief affirmative tone came from his communicator almost at once, and he let Moon-Watcher's hand drop back to the ground.

Ages after the little hominid's bones had dissolved into dust this recording of their farewell would still exist, to be recalled whenever Clindar pleased. He would add others to it, in the years and the millennia that lay ahead, until the time came-if it ever did-when at last he was tired of the Universe, and of immortality.

Silent as rising smoke, the bubble of the scoutship lifted from the African plain and dwindled into the sky. Moon-Watcher never saw it go; the gazelle he had killed now engaged his full attention. Soon he would forget his visitor-but not the gifts he had brought from the stars.

And his descendants would use them, with ever increasing skill, until it was time for the next meeting.

There was one small but important matter still to be arranged, and the ship landed briefly on the Moon to do it. In the lunar midnight, the cold rocks split

and scattered as the traction fields tore into them, digging the cavity that would protect the Sentinel from all foreseeable accidents of time and space. The black tetrahedron was set upon its supporting apron, and then sealed off from the light of the sun and the light of the earth. The broken rock was poured back into place; in a few thousand years, the incessant rain of meteor dust would have hidden the scar completely.

But the buried machine's magnetic signal would shout its presence to the empty sky, and any intelligence that came this way could not fail to observe it. If, ages hence, Moon-Watcher's descendants attained the freedom of space, they must pause here on the way to the stars, and those who had set them on the road would know that they were coming, and would prepare to welcome them.

Or it might be that a culture would arise on this planet flourish briefly in the innocent belief that the universe revolved around it, and then sink back once more into the dim twilight of preconscious thought, rejoining the animal kingdom from which it had emerged. Such civilizations were too numerous to be counted, far less examined, in this galaxy of a hundred billion worlds. Though they might contain many marvels and hold much of interest, yet one had to pass them by. Indeed, few lasted long enough for a second visit; they were ephemeral flashes of intelligence, flickering like fireflies in the cosmic night.

But once a species had begun to move out from its native world, and had become aware of the universe around it, it was worthy of attention. Only a space-faring culture could truly transcend its environment, and join others in giving a purpose to creation. Therefore such cultures had to be detected and cherished, when they merited it, which was not always the case. The sentinel beacons that now kept hopeful watch upon more than a million planets sometimes brought bad news as well as good.

As the ship lifted from the heart of Tycho, Clindar caught one last glimpse of the blue-green globe hanging motionless in the lunar sky. Africa was turned toward him, warming itself in the rays of the hidden sun. He wished he could have stayed longer-a hundred years, at least-but new worlds were calling, far down the unimaginable convolutions of the Star Gate.

It was unlikely that he would ever know the outcome of the chain reaction he had started here; the chances were that it would die out in a few generations, and leave no trace. In these early stages disease or changing climate or accident could so easily wipe out the glimmering, predawn intelligence, before it was strong enough to protect itself against the blind forces of the Universe.

For if the stars and the galaxies had the least concern for mind, or the slightest awareness of its presence, that was yet to be proved.

THE BIRTH OF HAL

The movie 2001 has often been criticised as lacking human interest, and having no real characters-except HAL. In leaping straight from the Pleistocene into space, Stanley Kubrick bypassed all the problems that would have been involved in developing the personal backgrounds of the astronauts, the political and cultural impact produced by the discovery of the monolith, and the general details of life at the beginning of the next century. We could have written a whole book about that; in fact, we did....

And when we had done so, we realized that it was irrelevant to the main theme of the movie. To have developed all this background material-besides adding a couple of hours to the running time and several millions to the cost-would have thrown the whole story out of focus. So the novel contains only a few pages set on Earth, 2001 AD, while the film ignores the subject completely, and jumps straight into space.

One of the problems facing any science-fiction writer who is aiming for the general public is how much to explain, and how much to take for granted. He must try not to leave his readers baffled, but at the same time must avoid those disguised lectures which are all too typical of the genre ("Now tell me, Professor...."). At one time, Stanley hoped to get around this problem-as far as the movie was concerned-by opening with a short documentary-type prelude, in which noted scientists and philosophers would establish the credibility of our theme. With this idea in mind, he sent Roger Caras around the world, to interview, on film, more than twenty authorities on space, computers, anthropology-even religion. They included the astronomers Harlow Shapley, Sir Bernard Lovell, Fred Whipple, Frank Drake; Dr. Margaret Mead (who was a space bug long before Sputnik) and the great Russian scientist A. I. Oparin, the first man to point out (in the 1920's) a plausible way in which life could arise from the simple chemicals of the primitive Earth.

These interviews, many of them quite fascinating, were never used-a fact which understandably upset some of the distinguished and busy men involved. (Transcripts of several interviews may be found in Jerry Agel's The Making of Kubrick's 2001.) But as it turned out, to have incorporated them in the film would have been aesthetically impossible; it also proved to be unnecessary. We did not have to educate the public, as the headlong rush of astronautical events did it for us.

While the film was in production, the first space rendezvous (Gemini VI and VII) took place. Luna IX landed in the Ocean of Storms and gave us our first close-ups of the lunar surface from a distance of a few inches. (Too late to help the Art Department-all our lunar scenes had already been shot-but fortunately our educated guesses had been pretty close to the reality.) Most astonishing and unexpected of all-the discovery of the first apparently artificial radio sources in outer space was announced just a month before the movie was premiered. (April 1968). We now believe that the so-called "pulsars" are natural objects (neutron stars), but it was interesting to see how ready the public and the scientists were to consider seriously the "Little Green Men" hypothesis.

And at the end of that same year, Apollo 8 looped round the Moon, and half the human race heard that unforgettable Christmas message from another world. It was just as well, therefore, that Stanley had thrown his audience straight into space, without wasting time on preliminaries. A cautious, pedestrian approach would have resulted in instant obsolescence.

Nevertheless, I was quite sorry to lose many of the Earthbound sequences, which established the background for the expedition to Jupiter (or Saturn, as we later decided in the novel version). They included several items of-I hope-painless exposition, such as the attempt in the chapter entitled "Universe" to describe a film giving the scale of the cosmos. I have since encountered two films (one by Charles Eames) made on precisely these lines. The section that follows also reveals the early evolution of HAL (or Socrates, or Athena, as he/she was christened in earlier versions). It will be seen that in the course of writing, HAL lost mobility but gained enormously in intelligence.

And while I am on this subject, I would like to demolish one annoying and persistent myth, which started soon after the movie was released. As is clearly stated in the novel (Chapter 16), HAL stands for Heuristically programmed ALgorithmic computer. (No, I'm not going to explain that, except to say that it gets the best of both worlds in computer design.) However, about once a week some character spots the fact that HAL is one letter ahead of IBM, and promptly assumes that Stanley and I were taking a crack at that estimable institution.

As it happened, IBM had given us a good deal of help, so we were quite embarrassed by this, and would have changed the name had we spotted the coincidence. For coincidence it is, even if the odds are twenty-six cubed, or 17,576 to 1. (Just checked by HAL Jr., the beautiful 9100A calculator that my friends at Hewlett-Packard gave me at Christmas 1969.)

The following seven chapters contain only part of the Earthbound background material that Stanley and I developed; I have omitted thousands of words of description and characterization which are no longer of interest. (There is no record that I ever answered Stanley's question: "Do they sleep in their pajamas?") What is left, however, is still relevant, and will be for a long time to come-until the first encounter with aliens actually takes place.

It will be noticed that in this first version we decided not to keep the purpose of the mission a secret; in reality, I very much doubt whether this could be done, for the length of time we assumed in the film. And on rereading, after all these years, the last chapter-"Midnight, Washington"-I have suddenly remembered that just four years after those words were written, I received an invitation to a White House d inner in honor of the first men who would fly around the Moon, that coming Christmas. But I was already on my way to Ceylon, and so missed the opportunity to wish good luck to Borman, Anders, and Lovell.

I have never quite forgiven Bill Anders for resisting the temptation, which he later admitted had passed through his mind, of radioing back to Earth the discovery of a large, black monolith on the Far Side of the Moon....

MAN AND ROBOT

"Bruno," asked the robot, "What is life?"

Dr. Bruno Forster, director of the Division of Mobile Adaptive Machines, carefully removed his pipe in the interests of better communication. Socrates still misunderstood about two percent of spoken words; with that pipe, the figure went up to five.

"Sub-program three three zero," he said carefully. "What is the purpose of the universe? Don't bother your pretty little head with such problems. End three three zero."

Socrates was silent, thinking this over. Sometime later in the day, if he understood his orders, he would repeat the message to whichever of the lab staff had initiated that sequence.

It was a joke, of course. By trying out such tricks, one often discovered unexpected possibilities, and unforeseen limitations, in Autonomous Mobile Explorer 5-usually known as Socrates or, alternatively, "That damn pile of junk." But to Forster, it was also something more than a joke; and his staff knew it.

One day, he was sure, there would be robots that would ask such questions-spontaneously, without prompting. And a little later, there would be robots that could answer them.

"Sub-program two five one," Bruno enunciated carefully. "Correction, recognition matrix for Senator Floyd. Erase height five feet eleven; insert height six feet one."

That should cover it, unless some other practical joker had been at the robot's memory. There had been one occasion when Socrates had welcomed a party of directors' wives with a passionate plea for a twenty-hour week and holidays with pay, and had ended by throwing accusations of brutality at his designer, whom he had repeatedly referred to as Dr. Bruno Frankenstein. It had been most convincing; some of the ladies were still looking suspiciously at Bruno when they left.

The door opened. Stepping lightly, gracefully, Socrates moved to meet the delegation.

"Good morning, Senator Floyd; welcome to General Robotics Division of Adaptive Machines. My name is Socrates; I would like to show you some of our latest work."

The senator and his colleagues were clearly impressed; they had seen photographs of Socrates and his predecessors, but nothing quite prepared one for the steel and crystal grace of the moving, talking reality. Though the robot was roughly the size and shape of a man, there were few of those disquieting echoes of the human body which make the metal monsters of horror movies either ludicrous or repulsive. Socrates possessed an inherent mechanical beauty that had to be accepted on its own terms.

The legs, rising from wide circular pads, were intricate assemblies of sliding shock absorbers, universal joints, and tensioning springs, held in a light framework of metal bars. They flexed and yielded at each step with a fascinating rhythm, as if they possessed a life of their own.

Above the hips-it was impossible to avoid some anthropomorphic terms-Socrates' body was a plain cylinder, covered with access hatches for his racks of electronic gear. His arms were slimmer and more delicate versions of the legs; the right one ended in a simple, three-fingered hand, capable of complete and continuous rotation, while the left terminated in a sort of multipurpose tool combining, among other useful elements, a corkscrew and beer can opener. Socrates seemed well equipped for most emergencies.

The upper part of his body was crowned not by a head, but by an open framework carrying an assorted collection of sensors. A single TV camera gave all-round vision, through four wide- angled lenses aimed at each point of the compass. Unlike a man, Socrates needed no flexible neck; he could see in every direction simultaneously.

"I am designed," he explained, as he walked with a curious rocking motion toward the Medical Section, "for all types of space operation, and can function independently or under central control. I have enough built-in intelligence to deal with ordinary obstacles, and to evaluate simple emergency situations. My current assignment is supervisor on Project Morpheus."

"He's got your accent," said Representative Joseph Wilkins to Bruno, rather suspiciously.

"That's correct," the engineer answered, "but it's not a recording. Though my voice was the mode, he generates the words himself. The grammar and construction are all on his own-and sometimes they're better than mine."

"And just how intelligent is he?"

"It's impossible to make a direct comparison. In some ways, he's no more intelligent than a bright monkey. But he can learn almost without limit, and he'll never get tired or bored. That's why we'll be able to use him as a back-up for human crews, on really long space missions."

"Ah yes, this Morpheus idea. I'm interested, but it gives me the creeps."

"Well, here it is. Now you can judge for yourself."

The robot had led the party into a large, bare room dominated by a full-scale mockup of a space capsule. A cylinder twenty feet long and ten feet high, with an airlock at one end, it was surrounded by pumps, electronic gear, recording equipment, and TV monitors. There were no windows, but the whole of the interior could be watched on a series of TV screens. One pair of these showed somewhat disquieting pictures-closeups of two unconscious men. Their eyes were closed, metal caps were fitted over their shaven heads, electrodes and pick-up devices were attached to their bodies, and they did not even appear to be breathing.

"Our sleeping beauties," said Bruno to Representative Wilkins. (And why, he wondered to himself with some annoyance, did he always lower his voice? Even if they were awake, they certainly couldn't hear him.) "Whitehead on the left, Kaminski on the right."

"How long now?" asked Wilkins, whispering in return.

"One hundred and forty-two days-but Socrates will tell you all about it."

The robot paused at the airlock entrance, and glanced around, uncannily like a human speaker sizing up an audience. That, thought Bruno, was not a programmed reaction, Socrates had either copied it or invented it himself. He was always doing things like this, as his learning circuits worked through their almost infinite number of permutations. Sometimes the reaction was wholly inappropriate and had to be blanked out; sometimes it was an amusing idiosyncrasy, like the apparently pointless little dance Socrates often performed when reactivated after a long shutdown; and occasionally it was useful. The robot's education was proceeding continuously, and so was that of its makers.

"This," began Socrates, "is Project Morpheus. Here we have two astronauts who, by a combination of drugs and electronarcosis, can be kept in a state of hibernation for prolonged periods. Their food and oxygen intake is thus cut ninety percent, greatly simplifying the supply problem. Equally important, this technique almost eliminates the psychological stresses produced when a group of men spend many months in confined quarters."

"What does he know about psychological stresses!" murmured Wilkins.

"You'd be surprised," Bruno answered glumly, thinking of several near-human tantrums that Socrates had thrown in the early days of his development.

"This technique," continued the robot, "is being developed for possible missions to the outer planets, which would involve very long flight times. During such flights, a robot like myself could run the ship and attend to the crew. It would automatically awaken them at the end of the journey, or if any emergency developed. If you will watch through the monitors, I will perform my daily check."

Socrates walked to the airlock entrance, and there conducted a ritual which clearly fascinated all the congressmen. With his bifurcated right hand, he twisted off the multi-purpose tool at the end of his left arm, and replaced it by a more normal, five-fingered hand that was virtually a large, padded paw. The operation was as quick as changing the lens on a camera, with it, Socrates had switched from general handyman to nurse.

The robot walked into the airlock, and a moment later appeared on the TV monitors that showed the inside of the capsule. He moved slowly down the central aisle, plugging a test probe into various instrument panels as he walked past them. His movements were swift and certain, like a trained human who knew his job perfectly.

He came to the sleeping men, leaned over them, and very gently checked the adjustment of their helmets and the location of their biosensors. There was something at once sinister and touching about this encounter between quasi-conscious machine and wholly unconscious humans all the spectators showed their involuntary tenseness. Even Bruno, who had watched this a hundred times before, felt apprehension mingle with his pride as chief designer and project engineer.

As Socrates, satisfied that all was well, straightened up and started to walk back toward the airlock, Representative McBurney of New York breathed a sigh of relief, and spoke for most of his colleagues when he said: "I don't think I'd care to go to sleep for a few months, with only a robot nursemaid to look after me. Are you sure it's safe?"

Bruno had hoped that someone would ask that.

"We've taken all imaginable precautions," he answered. "Every movement that Socrates makes is monitored from outside. If anything goes wrong, we'll push the stop button-but no one has had to do that yet. And let me show you something."

He walked to a microphone set in the wall of the capsule, threw a switch, and ordered: "Socrates-check operating mode."

At once the robot's voice boomed from a speaker.

"I am on independent mode."

Bruno turned to the visitors.

"That means he's operating on his own, not under external command. He's not a slave, but an individual. Now please watch this."

He breathed a silent prayer, then ordered: "Switch all oxygen systems off-repeat, off.''

Socrates stood for a moment in an attitude of paralyzed indecision, making no attempt to move. Then, after a pause that probably lasted only a second but seemed much longer, he answered: "Order rejected. Law-one violation."

Bruno gave a sigh of relief; the circuits weren't foolproof yet, and he had been taking a chance.

"Continue independent program," he said. Then he flashed a smile of satisfaction at the congressmen. "You see-he's well trained. He knew that cutting off the oxygen would endanger his charges, and that would violate the First Law of Robotics."

"The First Law?"

"Yes-we have them pinned up somewhere-ah, over there."

A large and rather grimy notice, obviously the work of an amateur artist, was hanging from the wall of the lab. Printed on it were the following words:

THE LAWS OF ROBOTICS

(1) A robot may not injure a human being, or through inaction, allow a human being to come to harm.

(2) A robot must obey the orders given it by human beings, except where such orders would conflict with the First Law.

(3) A robot must protect its own existence as long as such protection does not conflict with the First and Second Laws.

ISAAC ASIMOV (1920-)

Against each law was a little sketch. The First Law showed a diabolical metal monster cleaving a startled human in two with a battleaxe, while uttering the words: "Dr. Frankenstein, I presume." The second law was illustrated by a weeping lady robot, carrying a smaller replica of herself, obediently trudging out into the snow as directed by an irate Bruno Forster. And the third sketch showed an obviously insane and partly dismantled robot in the act of committing suicide with screwdriver and monkey wrench.

When the congressmen had finished laughing at these, Bruno explained: "We haven't got as far as the Third Law yet, and there may even be times when it's hard to decide if an act violates Laws One or Two. Obviously, a robot policeman would have to have different instructions from a robot nurse. But on the whole, these rules are a pretty sound guide."

"Isaac Asimov?" said Representative McBurney, "Didn't he give evidence to our committee, a couple of years ago?"

"I'll say he did-he was the lively old boy who wanted to build a high-pressure chemistry lab to study the life reactions that might take place on the giant planets. He got fifteen million out of us by the time he'd finished."

As they walked back to the capsule, Representative Wilkins waved toward it and said: "I'm still not completely convinced that this sort of thing is really necessary."

"It's not, at the moment," Bruno agreed. "But all our space journeys so far have been very short. Mars and Venus are only a few months away and as for the moon- why, you practically trip over it before you've started) Beyond Mars, though, the Solar System gets so much bigger. The journey to Jupiter takes at least a year, one way-which is why they're still arguing about sending men there. This-" he gestured toward the space capsule-"is how we may be able to get Project Jupiter off the ground. Hibernation will open up all the planets to manned exploration. And it may do much more than that, ultimately."

"What do you mean?" Senator Floyd, rather sharply.

"The stars, of course," answered Bruno, warming up to one of his favorite subjects. "We've found no intelligent life on the other planets of our own sun, so we'll have to look farther afield. How exciting it will be, to meet creatures wiser than us, yet perhaps using wholly different thought processes! We believe our systems of logic-and the ones we build into robots like Socrates-are universal but we can't be sure. The answers to that, and to a lot of other questions, lie out in the stars."

"But most of the scientists who've been up before our committee," said Floyd, "believe that flight to the stars will always be impossible, because of the enormous distances. They say that any trip, with propulsion systems that we can imagine, will take thousands of years."

"What if it does?" answered Bruno. "The solution's right here. We're not sure if simple hibernation stops the aging process, but we're fairly certain that deep-freezing does-and there are groups working on that, at Bethesda and San Antonio. I can imagine a ship starting on a ten- thousand-year voyage, with robots like Socrates in charge until the time comes to thaw out the crew."

Senator Floyd seemed to be thinking this over; he appeared to have forgotten the demonstration that had been so carefully arranged for his benefit. For the first time Bruno realized that the Senator, whom he knew rather well, had been very preoccupied during his visit to the lab; he was not his usual inquisitive self. Or he had not been until this moment; now something seemed to have triggered him off.

"Let me get this straight," he continued. "You think that flight to the stars-not just to the planets-is possible, and that robots could be built that would operate for thousands of years?"

"Certainly."

"What about-millions of years?"

That's a damned odd question, thought Bruno, what the devil is the old boy driving at?

"I certainly wouldn't guarantee a million-year robot with our present materials and technologies," he answered cautiously. "But I can imagine a virtually immortal automaton, if its thinking circuits were properly encapsulated. A crystal-a diamond, for example-lasts a long, long time; and we've already started building memories into crystals."

"This is all very fascinating," interrupted Representative McBurney of New York, "but I'm not a robot, and it's past lunchtime." He pointed to Socrates, who had now emerged from the capsule and, his programmed demonstration

completed, stood waiting further orders. "He may be satisfied with a few minutes plugged into a wall socket, but I want something more substantial."

"Eating food," said Bruno with a grin, "is a terribly inefficient and messy way of acquiring energy. Some of my friends in Biotechnology are trying to bypass it."

"Thanks for warning us-that's one project we won't support. I prefer the human body the way it is; and while we're on the subject, we do have another fundamental advantage over robots."

"And what's that?"

"We can be manufactured by unskilled labor."

Bruno dutifully joined in the laughter, though he had heard that particular joke a hundred times before and was just a little tired of it. Besides, what did it prove?

To Bruno, as to many of his colleagues, the machines with which he was working were a new species, free from the limitations, taints, and stresses of organic evolution. They were still primitive, but they would learn. Already they could handle problems of a complexity far beyond the scope of the human brain. Soon they would be designing their own successors, striving for goals which Homo sapiens might never comprehend.

Yes, it was true that-for a while-men would be able to outbreed robots, but far more important was the fact that one day robots would outthink men.

When that day came, Bruno hoped that they would still be on good terms with their creators.

FROM THE OCEAN, FROM THE STARS

Four thousand miles above the surface of Mars, experimental spacecraft Polaris 1-XE rested at the end of her maiden voyage. Her delicate, spindle-shaped body with its great radiating surfaces and ring of low-thrust ion engines would be torn to pieces by air resistance if she ever entered an atmosphere. She was a creature of deep space, and had been built in orbit around Earth; now she was as near to any world as she would ever be, suspended by a network of flimsy cables between two jagged peaks of Phobos, the inner satellite of Mars. On this fifteen-mile diameter ball of rock, the ship weighed only a few hundred pounds; for all practical purposes she and her crew were still in free orbit. Gravity here was little more than a thousandth of Earth's.

To David Bowman, now that his responsibility for the voyage was over, the spectacle of the red planet was a never-failing source of wonder. The glittering frost of the South Polar Cap, the brown and chocolate and green of the maria, the infinitely varied rosy hues of the deserts the movements of the occasional dust storms across the temperate zones-these were sights of which he never tired. Every seven hours the gigantic disk of the planet waned and waxed from full to new and back again; even when the dark side of Mars was turned toward them, it still dominated the sky, for it seemed as if a vast circular hole was moving across the stars, swallowing them up one by one.

David Bowman, biophysicist and cybernetics expert, still found it hard to believe that he was really floating here on one of the offshore islands of Mars-

the planet that had dominated his youth. He had been born in Flagstaff, Arizona, where David Bowman Sr. had spent most of his working life at the Lowell Observatory, center of Martian research since long before the dawn of the space age. It seemed only a few years ago that they had both been present at the observatory's centenary celebrations in 1994.

Percival Lowell, Bowman often thought, was really a man of the Renaissance, born out of his time. Diplomat, orientalist, author, brilliant mathematician, and superb observer, Lowell had focused the attention of the scientific world upon Mars and its "canals" in the early 1900's. Though most of his conclusions were now known to be erroneous, he was one of the patron saints of Solar System studies, and had kept interest in the planets alive during the decades of neglect.

The splendid 24-inch refractor through which he had stared at Mars for countless hours was still in use. Now, a hundred years later, the largest settlement on that planet bore his name-and a man whose father had known Lowell's own colleagues would soon be walking on the world to which the great astronomer had devoted his life.

The older Bowman had hoped that his son would step into his place, but though the boy was fascinated by the stars and spent many nights at the observatory, his real interests lay in the behavior of living creatures. Inevitably, that had led him into cybernetics, and the shifting no- man's-land between the world of robots and the animal kingdom. He had helped to design the circuits and control mechanisms that made this ship almost a living entity, with a central nervous system, a computer brain, and sense organs that could reach out into space for a million miles around.

How strange that, after he had turned aside from astronomy, his work should have brought him out here to Mars! When the docking had been complete, he had radioed his father: JUST LANDED SAFELY PHOBOS. NATIVES FRIENDLY. HOPE YOU CAN SEE ME THROUGH 24 INCHER. DAVID.

Less than half an hour later had come the reply: SORRY FLAGSTAFF CLOUDY WILL TRY TOMORROW LOVE FROM ALL DAD.

And what, David Bowman asked himself, would old Percival Lowell have thought of that?

Now something else was coming through from Earth, most brilliant of all the stars in the Martian sky. The printer in the communications rack of the tiny satellite base-manned only when a ship was arriving or departing from orbit-gave the faint chime that indicated the end of the message. Bowman floated across to the rack, holding onto the guide rope with his right hand, and tore off the rectangle of paper.

He read the few lines of type several times before he could really believe them. Then he began to swear, rather competently, in English and Navajo.

He had traveled fifty million miles, and at this moment was no further from Mars than New York from London. In a few hours, he should have been taking the shuttle down to Port Lowell.

But now he was not going to Mars at all, there would be no time for that. For some incredible reason, Earth was calling homeward the latest and swiftest of all its ships.

Peter Whitehead received his orders on the shore of the Sea of Fire, where a monstrous sun hung forever bisected by the horizon.* He had been sent to Mercury to install and supervise the life-support system for the first manned base on the planet, in the narrow temperate zone at the edge of the Night Land. A few years hence, this would be the starting point for expeditions into the furnace of the day side, where metal could melt at the eternal noon. But before that time came, a foothold had to be secured on Mercury, and the silver-plated domes of Prime Base nestled in a small valley where the deadly sunlight would never shine. That light lay forever in a band of incandescence upon the peaks two thousand feet above the settlement, moving up and down slightly as the weeks passed and the planet rocked through its annual librations. The reflected glare from the mountains could do no harm; in the valley it provided a kind of perpetual moonlight, with only a trace of the murderous heat.

*While these words were being written, radio observers were discovering-to the embarrassed amazement of the astronomers-that Mercury does not keep the same face always turned toward the sun. This wiped out a whole category of science-fiction stories overnight, but makes very little difference to surface conditions on the planet.

Whitehead was not sorry to leave. He had done his job, and unless one was a geophysicist or a devoted solar observer, Mercury's peculiar charms soon waned. When he got back to Earth, he decided, he would like to take a vacation in Antarctica. But he suspected-correctly-that he was not going to have a holiday for quite some time.

Slightly closer to Earth, Victor Kaminski was in orbit a thousand miles about the dazzling white cloudscape of Venus. In the three months that he had been here, aboard Cytherean Station One, those clouds had never broken, and had shown only the most fugitive changes of color and shading. They were as eternal as the day-and the night-of Mercury; probably the sun's rays had not reached the surface of Venus since life began on Earth.

Nor had any men yet descended through those clouds, into the heat and darkness and pressure of the planet's hidden lands. But there were many instruments down there, sending up their reports to the space station, scanning and probing their hostile surroundings with radar, sound waves, neutron beams, and the other tools of planetary exploration. As information accumulated, so the personality of Earth's nearest neighbor slowly emerged; it was fascinating to see old mysteries resolved, and new ones loom up on the frontiers of knowledge. What, for example, could possibly cause that steady, continuous roaring at 125 North, 52 West? It sounded like a waterfall-but there could be no waterfalls on a world where the temperature was far above that of superheated steam. Microphones had pinpointed the source to within five kilometers, yet so far no probes had managed to locate it.

This was only one of the problems that made life exciting for Victor Kaminski, astronomer and planetologist. Venus was a strange, unfriendly world, yet he had fallen in love with her. (He never thought of the planet as anything but feminine.) And now, to his anger and disappointment, Earth was calling him back.

He did not know it yet, but he was after far bigger game.

Two miles from the Queensland coast, the hydroskimmer Bombora (Mario Lombini Pty., Coolangatta-Motor Repairs) gently rose and fell in the waters of

the Great Barrier Reef. The three Lombini brothers, and the one Lombini sister, watched skeptically while their guest made the final adjustments to his new invention.

The object that William Hunter was kneeling beside looked, at first glance like a perfectly normal surfboard, painted a brilliant yellow. However, the curved leading edge was broken by a series of narrow slots, so that from the front it resembled an overgrown mouth-organ. There were two larger slots at the rear, on either side of the stabilizing fin.

Hunter turned a wide-bladed screwdriver, and a flush mounted panel opened in the underside of the board. The hollow interior held two slim gas cylinders and some neatly laid-out plumbing, as well as a few control wires and a tiny pressure gauge. After turning a valve and checking the gauge, he carefully replaced the panel.

"Stand back!" he warned, gripping the recessed handholds. There was a sudden high-pitched shriek of gas, and the board jerked like a living creature.

"Seems lively enough," said the satisfied inventor. "See if you can catch me."

He lowered the board into the water, lay flat upon it, and squeezed the throttle.

The smooth plastic shook and bucked beneath him, the oily, blue-green water slid by with satisfying swiftness inches beneath his nose. Leaving a wide, creamy wake, he took off in the general direction of New Zealand. He was too busy controlling the board to look back, but he knew that Bombora would be following on her cushion of air.

A great wave was humping up ahead; over or through? That was the problem, and Hunter usually made the wrong decision. He aimed the nose of the board slightly downward, took a deep breath, and squeezed the throttle controls.

A curving green wall rose above his head, and he slipped effortlessly through its surface into the roaring underwater world. For a few seconds the wave tugged him landward; then he was beyond its power and an instant later emerged, shaking the water from his eyes, on the other side.

He looked round for Bombora, but there was no time to locate her, for here came another wave, its wind-ripped crest hissing like a giant snake. Again he dived into the luminous green underworld, feeding the tiny hydrojets a three-second jolt of power.

He had almost lost count of the waves that had gone storming by when suddenly he was in quiet water, rising and falling on a gentle swell. Swinging the board around he looked back toward the coast-and swallowed hard

when he saw the huge, humped shoulders of the moving, liquid hills that now separated him from solid land. Where was Bombora?

Then he saw that the skimmer had used her speed to take a longer but smoother route out to sea, and had avoided the line of surf. He also saw that Mario was signaling to him-perhaps warning him not to attempt to shoot those waves. If the Aussies were nervous, he was certainly going to take no chances; he relaxed on the board, and waited.

Bombora came whistling up to him in a cloud of spray; and then, with a sinking heart, he saw that Mario was holding out the telephone.

"Call from Washington," said the senior Lombini, as he cut the engines and Bombora settled down on her floats. "I told them you weren't here, but it was no good."

He handed over the cordless receiver, and Hunter, still bobbing up and down on the board, heard the peremptory voice from the other side of the world. He answered dully: "Yes, sir-I'll be there at once," and then gave the instrument back to Mario.

Being the number one propulsion specialist of the Space Agency had its disadvantages. His holiday was over almost before it had begun, and the Lombini brothers would have to finish the development and marketing of the Squid. Worse still, his trip out to the Great Barrier Reef with Helena was also off, and he'd have to cancel their reservation on Heron Island.

Perhaps it was just as well, combining business with pleasure was seldom a very good idea. But that, he knew, was only sour grapes.

Twenty-two thousand miles above the earth, aboard Intelsat VIII, Jack Kimball had been rather more fortunate. It was not too easy to find privacy aboard the great floating raft which now handled most of the communications traffic of the Pacific area, but he and Irene Martinson had managed it, with most satisfactory results.

The ribald speculations which had grown with the Space Age were not altogether ill-founded. In the total absence of weight, some of the more exuberant fantasies of Indian temple art had moved into the realm of practical politics; one did not have to be an athlete to surpass anything that the ingenious sculptors of the great Konarak Temple at Puri had been able to contrive. And it was an interesting fact-which the psychologists had not overlooked-that reproductions of such art were rather popular in all the larger, permanently inhabited space stations.

There were those who argued that sex in zero gee was tantalizing, and not wholly satisfying. One school of thought insisted on at least a third of a gravity-which meant that its advocates would be happy on Mars, but permanently discontented on the Moon. As Kimball filed away his memories for future reference, he decided that those who felt this way had too many inhibitions, or too little ingenuity. Neither charge applied to him.

When they were both presentable again, he unlocked the door of the spacesuit storage locker. As he did so, Irene started giggling.

"Just suppose," she said, "that there'd been an emergency and everyone came rushing in here for suits."

"Well," grinned Jack, "we should have had a head start. When are you off duty again?"

Before she could reply, the corridor speaker cleared its throat and said firmly: "Dr. Kimball-please report to Control."

"Oh no!" gasped Irene. "You don't suppose they had a mike in there?!"

"If there is," said Kimball ominously, "we're not the ones in trouble. I have to authorize all circuit changes, and I'm damned if I ever said anything about mikes in suit lockers."

He realized, a little belatedly, that Irene might have a different point of view. Before she could express it, he kissed her firmly, said, "Give me a couple of minutes to get clear," and dived through the door.

Two hours later, just as he was about to reenter atmosphere, he suddenly realized that he had forgotten to say goodbye. Oh well, he would have to phone from Washington.

There were fewer complications that way.

Dr. Kelvin Poole was a hundred feet down, in the Cornell Underwater Lab off Bimini, when he received his orders. Like all aerospace physiologists, he was fascinated by the problems of submarine existence, but he had a particular reason for returning to the sea. His specialty was the study of sleep and the rhythms which seemed to control the activities of all living creatures. In the open sea, and at depths where the sunlight never penetrated, those rhythms were disturbed; it even appeared that some fish never slept at all, and Kelvin Poole wanted to know how they managed this remarkable feat.

He was supposed to be working, but the view from the window was not only distractingly beautiful-it was hypnotically restful. The water was so clear that he could see almost two hundred feet, and at a guess his field of view contained ten thousand fish of fifty different species-as well as several dozen varieties of coral. At this depth though the sunlight was still brilliant, it had lost all its red and orange hues; the world of the reef was tinged a mellow bluish-green, very soothing to the eyes. It looked incredibly peaceful-an underwater Eden that knew nothing of sin or death.

Nor was that wholly an illusion, now that the sun was still high. From time to time a barracuda or a shark would go patrolling past, without creating the slightest concern or alarm among its myriad of potential victims. During all the daylight hours while he had been staring out of the window of the biology lab, Poole had never once seen one fish attack or eat another. Only at dawn and sunset was the truce suspended, and the reef became the scene of a thousand brief and deadly battles.

He was watching one of the submarine scooters returning to the garage fifty feet away, towing plankton nets and recording gear behind it, when the telephone rang. Switching off the centrifuge that was rather noisily separating some protein samples, he picked up the receiver and answered, "Poole here."

He listened carefully for a minute, sometimes nodding his head in agreement, occasionally pursing his lips in disapproval.

"Of course," he said at last. "It's perfectly practical- you've read my report. There's an element of risk-but I'm still fit, and I've done it seven-no, eight-times. But why the rush? . . . Well, if that's the way it is . . . Yes, of course, I can fly to Washington in an hour, if you have a jet here-but there's one big snag."

He looked at the roof overhead, and contemplated the hundred feet of water above the metal shell of the lab. On dry land, he could walk that distance in

twenty seconds- but he had been down here, living at a pressure of four atmospheres, for almost a month.

This was going to be rather hard to explain. No one had ever found a safe way of accelerating the decompression process; Poole had seen the "bends" just once in his life, and he had a hearty respect for this dreaded divers' sickness. He had no intention of turning his bloodstream into soda water, or even risking a single bubble of compressed air in some inconvenient artery.

One could not argue with the laws of physics, Washington would simply have to accept the rather surprising facts.

It was going to take him just as long to ascend through that mere hundred feet of water above his head, as it would to come homeward from the Moon.

WITH OPEN HANDS

At first, there was some criticism of the risks being taken, but this slowly faded with the passage of time. The world began to appreciate the skill and care that were being poured into the mission, and to realize that this was no desperate, do-or-die stunt. At every opportunity, the astronauts themselves expressed full confidence in success; and they were the ones whose opinions really mattered.

Moreover, the ominous, silent presence of TMA-1 was now beginning to affect all mankind. The initial excitement had worn off, to be replaced by an undercurrent of anxious apprehension, and a determination to discover the truth as soon as was humanly possible. Until the meaning of that black pyramid was known, the whole world was in a state of uncertainty, unable to make any long-range plans.

For two diametrically opposite reasons, those involved in such vast international engineering projects as the Sahara Irrigation Scheme, the Gibraltar Dam, and the Sargasso Sea Farms now felt unable to commit themselves to the billions of dollars and decades of work required. It would obviously be foolish to plow vast resources into such enterprises, if there were hostile forces out there in space which might suddenly undo the toil of ages.

The second argument was more subtle, but in its way just as enervating. The creatures who had built TMA-1 were clearly far more advanced than mankind; suppose they were prepared to share their knowledge? To struggle ahead without their aid might be like building dams and roads with bare hands-while they had the equivalent of bulldozers and earthmovers.

Mankind was becoming slowly paralyzed by ignorance, and there were some who clamored for an all-out assault on TMA-1 itself with every weapon of scientific research. These appeals had been resisted; whatever secrets the pyramid held would probably be destroyed in the attempt to reach them. Moreover, it might have ways of defending itself-and there was the still more disturbing possibility that its makers, if not far away, would be annoyed by any action that damaged their property.

The stock market was particularly affected. It first took a mild dip, then rose again on the hunch that space issues would lead a general upward surge. "After all," an analyst wrote, "this could open up vast new markets for some industries." But no one was at all certain of what "they" might want to buy, or what "they" might use to buy it

One bright fellow negotiated a deal with several of the leading motion-picture distribution companies to buy the extraterrestrial rights to their entire library of back films- excluding the Moon, which had already been annexed by MGM.

Very privately, heads of government were deeply concerned about the possible threat such an incredibly advanced society might represent. No one could give a completely plausible reason why they might be hostile, but it was a possibility which could not be ignored.

A high-level, top-secret, military commission was set up by the major powers to study the possibilities of global defense. It would be unwise, they felt, to believe our weapons systems would mean a great deal against a culture at least three million years older, but a nuclear explosion might be annoying enough to deter a hostile but insufficiently motivated alien society. "We have absolute supremacy over a wasp's nest," one general explained, "but unless we have a damned good reason, we'll leave it alone."

Though this was mildly reassuring, most pessimists felt the problem would not be that "they" were invulnerable to a nuclear explosion-but that our delivery systems might be like Brazilian headhunters trying to spear lowflying supersonic aircraft.

The optimists refused to believe that an advanced extraterrestrial society would behave in a hostile manner. They felt that the fantastic knowledge of three million years must bring an equivalent advance in ethics and morality- or else, it was argued, any society would eventually destroy itself.

In countless subtle ways, that silent pyramid was leaving its mark upon the world. It had long been predicted that only an external threat could really unite mankind; this prediction now appeared to be coming true. Behind the scenes, statesmen were already at work, trying to end the national rivalries that had been in existence so long, and of which few could remember the origin. There was even a chance that the concept of world government, that battered dream of the idealists, would soon become reality, though for reasons that were hardly idealistic.

And as far as the mission was concerned, one vital matter of policy had already been decided-even though there were some who considered that it was taking good manners beyond the point of common sense.

The human race, until it knew what it was up against, would be well behaved. Whatever preparations might be made back on Earth, no weapons of any kind would be carried to Jupiter.

Man's emissaries would go into the unknown with open hands.

UNIVERSE

"But this is absurd," protested Victor Kaminski. "I'm not a bloody film star."

"Agreed," said Jules Manning, the Space Agency's Director of Public Affairs. "But you are the best-known astronomer in the world. If you do the commentary, we'll multiply the audience many times over. And the major networks will rush to carry it-especially as it won't cost them anything.

"I'm not even a particularly good astronomer-only a particularly healthy one, unaddicted to cannibalism, homosexuality, postnasal drip, and similar habits Not Wanted on Voyage. Or so the psychologists tell me."

"Seriously, Victor-you'll be doing the whole project a great service, and it won't take much of your time. Once you've read the script, the whole job can be done in an afternoon."

"I don't have any afternoons. Is it really all that important?"

"We think so. The last survey was rather depressing. Even now, twenty-three percent of the public thinks that the Sun is nearer than the Moon, that there are only a few thousand stars, and that they're not very big anyway. You can strike a major blow for education, and for astronomy if you'll go along with this."

"I'll make a deal-I'll speak the introduction. But I'm damned if I'll deliver the whole commercial-you'll have to get one of your tame actors for that. Agreed?"

"Agreed," said Manning promptly. He knew that half a loaf was better than no loaf at all. And, with a little patience and persuasion, he might yet get the other half as well.

MAN IS THE MEASURE OF ALL THINGS, burned the slogan on the screen, then, superimposed on the lettering, appeared da Vinci's famous drawing of the standing human figure inscribed in a circle.

"If this statement is indeed true, and not vanity," began the commentator, "we can use man as a yardstick to measure the universe. Of course, he is a very short yardstick; so let us multiply him a thousandfold...."

The camera zoomed away, the figure dwindled until it was barely visible. Then it reproduced itself hundreds of times, to form a dotted line-one side of an empty square.

"Here is our man-our yardstick-one thousand times repeated. That square is a mile* on a side. Now we'll keep on changing scale-a thousandfold each time-until we have reached the edge of the known universe. And because we'll have to make quite a few jumps, let us write down the scale factor as a reminder."

*Hopefully, by 2001 even the U.K. and the U.S. will have joined the civilized world and adopted the metric system.

The number 1000 appeared on the bottom of the screen. Then the square began to shrink, the digits blurred swiftly-and a new square appeared, with the number 1,000,000 beneath it. This 1000-mile-on-a side square was superimposed on the eastern seaboard of the United States; the original one-mile square was still just visible, marked by an arrow.

"Now we jump again, another thousand times...."

The number 1,000,000,000 came up, and in the million mile-wide square on the screen appeared Earth and Moon, looking quite small.

"Now we are out into astronomical space, and we are dealing with numbers that are already too large for comprehension. We need a more convenient measure, and we can get it by using the fastest thing in the universe-light itself. .

"A beam of light could go round our entire globe seven times in a single second...."

Here a glowing spot appeared beside the Earth, and blurred into a circle as it orbited the globe once every seventh of a second.

"And it takes just over a second to reach the Moon...."

The spot broke away from its orbit, and sailed across to the tiny disk of the Moon, taking 1 1/4 seconds for the trip.

"Now our next thousand-to-one jump-the fourth since we started with that man, back on Earth...."

Here were all the planets out to Jupiter-the whole inner Solar System: Sun, Mercury, Venus, Earth, Mars, and Jupiter itself.

"On this scale, the planets are too small to be seen, we can only show their orbits. The picture is a billion miles on a side; light or radio waves would cross it in just over an hour. It shows the volume of space we have begun to explore; by our standards, it is enormous. All the men who have ever lived, laid end to end, would span about one tenth of it. But by the standards of the Universe, it is nothing. Here comes jump number five...."

The square shrank again; the number 1,000,000,000,000,000 flickered on to the screen. In the center of the new square, there was just one shining point-the Sun.

"The planets, of course, have vanished completely. But notice this-for the first time, nothing new has entered the picture. Even this huge jump has not taken us to the very nearest of the stars.

"If we wish to see them, we must jump again...."

1,000,000,000,000,000,000 flashed up, now the new square was dotted with dozens of tiny points of light.

"At last we enter the realm of the stars. There are a few hundred of them in this picture, which light takes 150 years to cross-the light which, remember, went from Earth to Moon in little more than a second. Of these stars, our own Sun is a perfectly average specimen. And because it is so average-so normal-we believe that many of the other stars are accompanied by similar planets, though they are too distant for our telescopes to show them. More than that-we also feel certain that many of those planets must have life.

"On this scale, the stars-our neighboring suns-appear scattered at random. But when we make the next, and seventh, thousandfold jump, we see that they form a pattern...."

Up came the number 1,000,000,000,000,000,000,000, and now even the individual stars had vanished. There was only a great spiral of glowing mist, almost filling the outlines of the square.

"This is the Galaxy-the slowly turning city of stars of which our Sun is a modest suburbanite-somewhere about here."

An arrow pointed to a region two-thirds of the way out from the center of the spiral.

"It takes light a hundred thousand years to cross this immense whirlpool of suns-this island universe. And it is turning so slowly that it has made only a dozen revolutions since life began on Earth.

"Call this the Home Galaxy, if you wish. The stars you see in the night sky are merely the local residents-most of them very close at hand. The more distant ones form the glowing background we call the Milky Way.

"And how many stars, how many suns, would you guess that the whole Galaxy contains? If you said a few million, you would be hopelessly in error. A few billion would be better; there are, in fact, about a hundred billion stars in the Galaxy. Every one of those a sun-thirty of them to every man, woman, and child now alive.

"We will return to our own Galaxy again-after we have seen the still greater background of which it is a tiny part. So once more we multiply our scale a thousand times....

"Yes, it looks like a field of stars. But it is not: each of those tiny smudges of light is a whole galaxy-this one might be ours. Our splendid star-city of a hundred billion suns, now reduced to a faint star itself. It would take light a hundred and fifty million years to cross this picture; this is how far we have gone in eight jumps, each of a thousand times, from the man we started with....

"But now-at last!-we are coming to the end of the line. For if we make one more jump, we run out of space itself...."

In the center of the screen, filling only a small fraction of the square frame that had surrounded each of the earlier pictures, was a globe of light. Its edges were slightly diffuse, fading away into the nothingness around it.

"This may be all of Creation-the Universe of Galaxies. Beyond this region, our most powerful telescopes cannot penetrate; indeed, there may be no beyond. For out at the cosmic horizon, at the ultimate limits of our vision, the galaxies themselves are disappearing from our sight, as if falling over the edge of space. What happens here we do not know; it may well be something which our minds can never grasp.

"So let us return from these far reaches, back to our Home Galaxy, with its hundred billion suns...."

The shining globe of the Cosmic All expanded at a dizzying speed. Presently its uniform glow broke up into tiny grains of light; these too expanded and drove apart. The screen was once more full of little whirlpools and spirals-some tangled in clusters, some alone. One of them grew and grew until it spanned the sky, and its raveled edges condensed into knots of stars.

"Our home galaxy, again, with its hundred billion suns," repeated the commentator, "most of them are little suns like our own-too small to be visible

on this scale. All those you see here are giants; ours is only a dwarf, despite its overwhelming importance to us.

"And of those hundred billion suns, large and small- how many shine upon worlds that carry life? Perhaps most of them, for matter has the same properties throughout the universe. We know that life arose independently on Earth and Mars. we believe that it arises automatically on all worlds that are not too hot or cold, that have the common elements of oxygen and carbon and hydrogen, and that are bathed by sunlight for a few billion years.

"Yet even if life is common, intelligence may be rare; in the long story of Earth, it has evolved only once. Nevertheless, there may be millions of advanced cultures scattered throughout the Galaxy-but they will be separated by gulfs that light itself takes years to span."

Two arrows appeared, aimed at stars so close together in the sparsely populated outer arms of the Galaxy that they seemed to be neighbors.

"If this was our Sun, and we sent a radio signal to a planet circling this nearby one, it would take a thousand years for the reply.... Or, to put it in another way, we might expect an answer now, if the message left our world around the birth of Christ.... And this would be a conversation with one of the closest of our galactic neighbors.

"Yet even if it takes thousands of years to travel from star to star, a really advanced race might attempt the feat. It could send robot ships exploring for it-as Man has already sent his robots ahead of him to explore the Moon and planets."

There were shots of ungainly space probes-some familiar, others obviously imaginary-drifting across the stars, peering down at passing worlds with their television eyes.

"Or they might build huge space arks-mobile planetoids which could travel between the stars for centuries, while generation after generation lived and died upon them....

"Or they might hibernate, or be frozen in the changeless sleep of suspended animation, to be awakened by robots when their age-long journey neared its end....

"Even these are not the only possibilities. A very advanced race might be able to build ships that could attain almost the speed of light. According to Einstein, no material object can travel faster than this; it is the natural built-in speed limit of our universe. However, as we approach this speed, time itself appears to slow down. A space traveler might fly to a distant star in what, to him, appeared to be only a few months-or even a few hours.

"But only to him. When he returned from his destination, he would find that years or centuries had passed, that all his friends were dead, and, perhaps, that his very civilization had vanished. That would be the price of stellar exploration-trading Time for Space, with no possibility of refund. Yet the price might be attractive, to creatures whose lives are much longer than ours.

"Finally-perhaps Einstein's theory, like so many theories in the past, does not tell the whole truth. There may be subtle ways of circumventing it, and so exceeding the speed of light. Perhaps there are roads through the universe which

we have not yet discovered-shortcuts through higher dimensions. 'Wormholes in Space,' some mathematicians have called them; one might step through such a hole-and reappear instantaneously, a thousand light-years away.

"But even if this is true-and most scientists think it pure fantasy-the exploration of the universe will still require unimaginable ages. There are more suns in the whole of space than there are grains of sand on all the shores of Earth; and on any one of those grains, there may be civilizations that will make us look like primitive, ignorant savages.

"What will we say to the peoples of such worlds, when at last we meet? And what will they say to us?"

"Thank you, Victor," said Manning when the screen blanked out and the red light in the dubbing room went off. "I knew you'd do it. Don't worry about the fluffs- we'll fix them. Anyway-what did you think of it?"

"Not bad-not bad. But I wish you hadn't put in that nonsense at the end."

"Eh? What nonsense?"

"Higher dimensions, wormholes in space, and all that rubbish. That's not science; it's not even good science fiction. It's pure fantasy."

"Well, that's exactly what the script said "

"Then why bring it in? Whose bright idea was it?"

"One Dr. Heywood Floyd's, if you want to know. I suggest you take it up with him."

Kaminski really meant it, but somehow the matter slipped his mind. There was so much work to do, so much to learn, that it was months before he thought of it again.

And then it was far, far too late.

ANCESTRAL VOICES

The ape-man stood on a low, rocky hill, grasping a pointed stone and looking out across a dusty African plain. Overhead, the sky was cloudless, and a hot sun baked the yellowing grass of the savannah and the stunted trees which provided the only shade. In the middle distance, a small herd of gazelles was browsing, watched intently by a saber-toothed tiger crouching in the scrub.

There were more ape-men-about a dozen of them- scattered over the crown of the little hill. Propped up against a large boulder, one female was nursing her baby; not far away, two juveniles were quarreling over a hunk of meat-all that was left of some small dismembered animal. One bent and gray-haired male was trying to suck the marrow from a cracked bone; another was curled up asleep; two females were grooming each other for lice; and yet another male was hunting through a pile of dried bones in search of future weapons.

"It's a beautiful model," said Bowman at last, when he and his two companions had looked their fill.

"Thank you," answered the curator of Anthropology. "It's as accurate as humanly possible several years of work went into it."

Dr. Anna Brailsford was a striking, dark-haired woman in her early forties, who seemed much too vivacious to have devoted her life to fossils. Though she was a famous explorer and veteran of many expeditions, she had lost none of her femininity; it was hard to believe that she was one of the world's leading authorities on early Man.

"So these," said Phillip Goode, Bowman's understudy, "are the characters the pyramid-makers would have met, if they landed on Earth three million years ago?"

"Not necessarily. It depends on the thoroughness of their investigation. Australopithecus was probably not very common; he might easily have been overlooked among the elephants and giraffes and other more conspicuous animals. In fact, he wasn't even the most impressive of the primates. To a casual visitor, he might have seemed just another ape."

It was rather difficult, thought Bowman, to take so detached a view. His great-to-the-hundred- thousandth grandfather was not a very prepossessing sight, but there was a wistful sadness about the hairy, no-longer-quite animal face staring at him through the glass of the diorama. He was not ashamed to admit kinship with his remote ancestor across the unimaginable ages that sundered them. "I rather doubt," he said dryly, "that creatures landing on Earth back in the Pleistocene would have been casual visitors. And this is one of the things we wanted to discuss with you-their motivations."

"Well, I can only tell you how I'd behave, in the same circumstances. I'd note that Earth was teeming with advanced life forms, but that none of them had developed high intelligence. However, I'd probably guess-I might even be able to predict, with the knowledge I'd undoubtedly have-that intelligence would arise in a few million years.

"So I'd leave behind some intelligence monitors-or, better still, civilization detectors. I might put some of them on Earth, though I'd realize that they would probably be destroyed or buried before they had a chance to operate. But the Moon would be an ideal spot for such a device especially if I was only interested in civilizations that had reached the space-faring stage. Any culture still planet-bound might be too primitive to concern me."

"So you're in favor of the fire-alarm theory, as we call it, to explain TMA-1?"

"Yes-it seems very plausible. But perhaps it's too plausible. Human motivations vary so much that any attempt to analyze wholly alien behavior must be pure guesswork."

"But guesswork is all we have to go on for the present. We're trying to think of every possibility that may arise, when and if we do catch up with the creatures who built TMA-1."

Bowman pointed to the frozen tableau of his ancestors.

"Look how far we've progressed since then! Yet after that same three million years, where will the pyramid makers be? I don't mind admitting it-the thought sometimes scares me."

"It scares me. But remember, progress is never uniform; even after three million years, they may not be incomprehensibly far ahead of us. Perhaps there's a plateau for intelligence that can't be exceeded. They may already have reached it when they visited the Moon. After all, it has yet to be proved that intelligence has real survival value."

"I can't accept that!" protested Bowman. "Surely, our intelligence has made us what we are-the most successful animals on the planet!"

"As an anthropologist, I'm naturally biased in favor of Man. From the short-term point of view, intelligence has undoubtedly been an advantage. But what about geological time-and how do you define a 'successful' species? My friend the curator of reptiles keeps reminding me that the dinosaurs flourished for more than a hundred million years. And their I.Q.'s were distinctly minimal."

"Well, where are they now? I don't see any around today."

"True-but you can't call a hundred-million-year reign a failure; it's a thousand times as long as Homo sapiens has existed. There may be an optimum level of intelligence, and perhaps we've already exceeded it. Our brains may be too big-dooming us as Triceratops was doomed by his armor. He overspecialized in horns and spikes and plates; we overspecialized in cerebral cortex. The end result may be the same."

"So you believe that as soon as a species reaches more than a certain level of intelligence, it is heading for extinction?"

"I don't state it as a fact, I'm merely pointing out the possibilities. There's no reason to assume that the universe has the slightest interest in intelligence-or even in life. Both may be random, accidental by-products of its operations, like the beautiful patterns on a butterfly's wing. The insect would fly just as well without them; our species might survive as long as-oh, the sharks, which haven't changed much in a couple of hundred million years-if we were a little less clever. Look at the daily newspapers, and the history of the whole twentieth century."

Dr. Brailsford smiled at her obviously disapproving audience.

"No-I'm not a pessimist," she said, answering their unspoken accusation. "Just a realist, who knows that only a tiny fraction of the species that have lived on this planet have any descendants today. And because I am a realist, perhaps I understand the importance of your project better than you do."

"Go on, please."

"The creatures who built the pyramid-how far ahead of us would you say they were from the technical viewpoint?"

"Probably no more than a hundred years, at our present rate of progress."

"Exactly. Now suppose that they are still in existence, even if they've made little progress during the three million years since they visited the Moon. Don't you see-this will be the first definite proof that intelligence does have real survival value. That will be very reassuring."

"Quite frankly, doctor," said Goode, "I don't need any reassurance. Even if intelligence has limited survival value, it has a good deal of comfort value. I wouldn't change places with them." He jerked his thumb toward the tableau of ape-men.

The anthropologist joined in the laughter; then she became serious again.

"There's another possibility, though-and that's cultural shock. If they are too advanced, and we come into contact with them, we may not be able to survive the impact psychologically. As Jung put it, half a century ago, we might find all our aspirations so outmoded as to leave us completely paralyzed. He used a rather striking phrase- we might find ourselves 'without dreams.' Like the Atlanteans, you know-Herodotus said that they never dreamed. I always thought that made them peculiarly inhuman-and pitiable."

"I don't believe in cultural shock," said Hunter. "After all, we expect to meet a very advanced society. It wouldn't be such an overwhelming surprise to us as-well, as it would be to him, if he was suddenly dumped here in Manhattan."

"I think you are too-optimistic," answered Dr. Brailsford; Bowman guessed that she had been tempted to use the word "naive." "On our planet, societies only a few generations apart culturally have proved to be incompatible."

"Perhaps our Pleistocene astronauts were aware of the danger-perhaps that's why they've left us alone, all these years."

"Have they?" said the anthropologist. "I wonder. If you'd like to come to my office now, I've something to show you."

They walked out of the Leakey Memorial Exhibit, through the great, cathedral-like halls of the museum. From time to time Bowman was recognized by other visitors, and several eager youngsters rushed up for his autograph. Goode and Hunter were not asked for theirs, but they were accustomed to this; Goode was fond of quoting, a little ironically, Milton's line "They also serve who only stand and wait."

Bowman's relationship with his two understudies was, on the whole, excellent-which was not surprising, for their intellectual and psychological profiles had been matched with great care. They were colleagues, not competitors, and they were often able to act as his alter egos, reporting back to him after missions and trips which he was too busy to make. Of course, each hoped that he would be the one finally selected, but they served Bowman loyally and with the minimum of friction. They had had disagreements, but never a serious quarrel-and so it had been with the other five trios. The psychologists had done their work well; but by this time, they had had plenty of practice.

Every time he entered a place like the Natural History Museum, Bowman was overwhelmed by the infinite variety of life produced by evolution on a single world, this one planet Earth. As he walked past the great displays with their panoramas of scenes from other times and other continents, he realized again the sheer foolishness of the question he was so often asked about the builders of the pyramid: "What do you think they looked like?"

Even if one were given every relevant fact about Earth's climate, geography, atmosphere, and chemical composition, who could have predicted the elephant, the whale, the giraffe, the giant squid, the duck-billed platypus-or Man himself? How infinitely more impossible it was, therefore, to make sensible

guesses about the inhabitants of a totally unknown, and perhaps quite alien, planet! Yet it was equally impossible to stop trying....

Dr. Brailsford's office was that of any museum curator- piled high with books, reports, journals from other institutions, exhibits being packed and unpacked, and hundreds of small drawers which covered two whole walls. On her desk were several skulls; she picked up one and said: "Here is the gentleman we have been talking about; not much of a forehead yet, but he's taken the first step toward us. And I mean first steps; even today, none of the other anthropoids are good walkers."

She placed the skull reverently back into its bed of cotton wool, then began ruffling through the folders drawings, maps, and photographs on her crowded desk. Presently she dug out a large book,* opened it at a marker, and handed it over to her visitors.

*The Search For the Tassili Frescoes, Henn Lhote

"My god!" said Hunter. "What the devil is that?"

"That" was a line drawing of a looming, roughly anthropomorphic figure, shown from the waist up. The head appeared to be covered by some kind of helmet, in the center of which was a large, Cyclopean eye. Another, smaller eye was tucked away in one corner of the helmet there were no other features, and by no possible distortion or artistic license could it be converted into a human face.

"Thought-provoking, isn't it? It's a Paleolithic cave painting, found in the Sahara half a century ago-back in 1959. And it made such an impression on the discoverers that, believe it or not, they christened it the 'Great Martian God."

"How old is it?"

"About ten thousand years. Not very old compared with your TMA-1-but ancient enough by human standards."

There was a long and profound silence while the three astronauts studied the painting. Then Hunter asked: "Do you really think it's a record of a meeting with extraterrestrials?"

"Frankly, no. It's probably a medicine man or witch doctor wearing some peculiar hairdress. I should have mentioned that it's extremely large-about eighteen feet high-so the artist obviously considered it quite important."

"Or it was something that made a big impression on him. I guess a spacesuit back in the Stone Age would create a sensation."

"Not necessarily, you should see a New Guinea devildancer in full regalia. But I think we can draw a lesson from this; just suppose it was a visitor from space, wearing some kind of protective suit. Granted that, I think you'll agree that the Stone Age artist did a fine job of recording something utterly incomprehensible, and beyond the farthest limits of his own culture. Could you do as well, if you encountered a supercivilization?"

"Perhaps not-but at least we have cameras."

"Even in photographs, you can only recognize things you already know. The shapes and colors of a really advanced civilization might be so strange that we might go mad trying to interpret them. Its time scale, too, might be incompatible with ours-faster, for example. Suppose you put Australopithecus in a car and drove him at high speed down Broadway one night. What sense would he make of it?"

"I see your point," said Bowman. "So what should we do, if we ever find ourselves in a similar situation?"

"I would say-try to become a passive recorder of events, and not attempt to understand anything. Take as many photographs as possible. And, of course, hope that the entities you meet are patient, and aware of your limitations."

"And if they are not?"

"Then I am afraid you will survive just about as long as Australopithecus would-if he got out of the car and tried to cross Broadway against the lights."

THE QUESTION

The weeks of preflight checkout in orbit went smoothly and uneventfully, as they were supposed to do. There was only one moment of drama and emotion: the christening of the ship.

Officially, most spacecraft have only numbers. Unofficially, they all have names, as ships have since the beginning of time. This one, the astronauts decided, would be called Discovery, after the most famous of polar exploration ships. It seemed appropriate, for they were going into regions far colder than the South Pole, and the discovery of facts was the sole purpose of their mission.

But how does one christen a spaceship, in orbit two hundred miles above the earth? The traditional champagne bottle was obviously out of the question, and the distinguished ladies who were expected to wield it would balk at carrying out the ceremony while floating around in spacesuits. Some kind of compromise was necessary.

Almost eighteen times a day, the ship passed directly above every point on the equator. The largest city beneath its path was Nairobi, and here, at night, the christening took place.

The lights of the city were extinguished, and all eyes were turned to the sky, when the world's First Lady made a brief speech of dedication and, at the calculated moment, said, "I christen you Discovery." Then, with all eyes upon her as she stood regal and resplendent in her tribal robes, the Secretary-General pressed a switch.

Directly overhead, a dazzling star burst into life-the billion-candlepower flare that was drenching both Space Station One and Discovery with its brilliance. It moved slowly from west to east while the whole world watched-both from the ground, and through cameras on the station. The fastest vessel built by man had been christened by the swiftest of all entities, light itself.

Other much more important events in the program were less publicized; and there was one that took place in complete secrecy.

Weeks ago, the final team selection had been made, and the twelve back-ups had swallowed their disappointment. It had been short-lived, for they knew that their time would come; already they were looking ahead to the rescue mission-the Second Jupiter Expedition-which would require them all. Yet, even now, at this late moment, there was a chance that some of them might leave with Discovery....

The Space Center's large and lavishly equipped operating room contained only three men, and one of those was not conscious of his surroundings. But the figure lying prone on the table was neither sleeping nor anesthetized, for its eyes were open. They were staring blankly at infinity, seeing nothing of the spotless white room and its two other occupants.

Lester Chapman, Project Manager of the Jupiter Mission, looked anxiously at the Chief Medical Officer.

"Are you ready?" he asked, his voice in an unnecessarily low whisper.

Dr. Giroux swept his eyes across the gauges of the electrohypnosis generator, felt the flaccid wrist of his subject, and nodded his head. Chapman wet his lips and leaned over the table.

"David-do you hear me?"

"Yes." The answer was immediate, yet toneless and lacking all emotion.

"Do you recognize my voice?'

"I do. You are Lester Chapman."

"Good. Now listen very carefully. I am going to ask you a question, and you will answer it. Then you will forget both the question and the answer. Do you understand?"

Again that dead, zombie-like reply.

"I understand. I will answer your question. Then I will forget it."

Chapman paused, stalling for time. So much depended on this-not millions, but billions of dollars-that he was almost afraid to continue. This was the final test, known only to a handful of men. Least of all was it known to the astronauts, for its usefulness would be totally destroyed if they were aware of it.

"Go on," said Giroux encouragingly, making a minute adjustment to the controls of the generator.

"This is the question, David. You have completed your training. In a few hours you go aboard the ship for the trial countdown. But there is still time to change your mind.

"You know the risks. You know that you will be gone from Earth for at least five years. You know that you may never come back.

"If you have any mental reservations-any fears which you cannot handle-you can withdraw now. No one will ever know the reason. We will have a medical cover story to protect you. Think carefully. Do you really want to go?"

The silence in the operating room stretched on and on. What thoughts, wondered Chapman with desperate anxiety, were forming in that brain hovering on the borders of sleep, in the no man's land of hypnosis? Bowman's training had cost a fortune, and though he could be replaced even now by either of his back-ups, such a move would be certain to create emotional strains and disturbances. It would be a bad start to the mission.

And, of course, there was even the remote possibility that both back-ups would take the same escape route. But that was something that did not bear thinking about....

At last Bowman spoke. For the first time there seemed a trace of emotion in his voice, as if he had long ago made up his mind, and would not be deflected or diverted by any external force.

"I . . . am . . . going . . . to . . . Jupiter," he said.

And so, each after his fashion, presently answered Whitehead and Poole and Kimball and Hunter and Kaminski. And not one of them ever knew that he had been asked.

MIDNIGHT, WASHINGTON

The reception at the Little White House, as the vice-president's mansion was invariably called, was one of the events of the season. There was much heart-burning because invitations were restricted to those associated with the project; but if this had not been done, most of official Washington would have been there. Moreover, everyone wanted to keep this as small and intimate as possible; it would be the last time all six astronauts would be gathered together on Earth, and the last opportunity for many of their friends to say farewell to them.

No one mentioned this, but everybody was aware of it. So this was no ordinary reception; there was a curious emotional atmosphere-not one of sadness or foreboding, but rather of excitement and exaltation.

"Look at them!" said Anita Andersen as she and Floyd orbited together across the dance floor. "What do you suppose they're really thinking?" She nodded her head toward the little group around the Vice-President and Mrs. Kelly; their hosts were talking to Bowman, Kaminski, Whitehead, and Poole.

"I can probably tell you," Floyd said. "By this time, I know as much about them as any of the psychologists. But why are you interested?"

His curiosity was genuine, quite unaffected by any taint of jealousy or sexual rivalry. (Besides, who could be jealous of six men about to leave Earth for years, perhaps forever?)

"It's hard for a woman to understand," Anita murmured above the background of the music, as they swirled round the little island of trees in the center of the dance floor. "Leaving all this behind, going off into space, not knowing what they're going to find, or even if they'll come

"I thought there was Viking blood in your veins," Floyd chided gently.

"I was always sorry for their women; they must have spent half their lives wondering if they were widows."

"At least we've avoided that problem here. There will be some unhappy girl friends, but that's all." He lowered his voice. "Here comes one of them."

Jack Kimball swirled by, his arms around a rather plump, vivacious blonde. As they were swept away by the other dancers, the girl suddenly began to laugh at something her consort had said.

"She certainly doesn't sound unhappy," commented Anita.

"Excellent. I shouldn't tell tales, but Jack has quite a reputation. Perhaps she realized that she couldn't hold on to him, and is making the best of a bad job."

"Bowman's the one who fascinates me, I've heard such conflicting stories about him. Is he really unpopular?"

"It depends on the point of view. He's a perfectionist. He can't stand people who aren't fit, or machines that won't work-and that makes life tough for his associates. Incidentally, he also seems to be lucky-he's never been involved in an accident. Maybe he's earned his luck; either way, we want to share it."

"But his crewmates?" persisted Anita. "Do they like him?"

"They like him, otherwise, he wouldn't be there. He has that indefinable quality we call leadership-people will trust his decisions, and feel confident that he's made the correct ones. And ninety-nine percent of the time, he has. We can only hope he'll keep up that batting average, when he gets out to Jupiter."

"The one I really like," confided Anita, "is Dr. Poole. There's something warm and friendly about him-not that the others are unfriendly, of course."

"Everyone feels the same way about Kelvin. He cares for people-but sometimes I wonder if he cares enough for himself."

"What do you mean by that?"

"It's hard to express, and I may be seeing things that aren't there. Probably I can't understand the medical viewpoint-to an astronomer, physiology is so damn messy. But sometimes I think that Kelvin takes too many risks with himself. He's had several narrow escapes; he was nearly drowned-twice-testing artificial lungs. He's always breathing peculiar atmospheres, riding centrifuges, trying out medical gadgets. And I've lost count of the number of times he's hibernated."

"You make him sound just a little peculiar. I'm surprised he passed the psychological tests."

Floyd laughed.

"He helped to set most of them, and you know what a tight labor union the doctors have. But I don't mean that Kelvin is psychotic. I suspect he's just an unusually dedicated medical researcher, who finds that he's his own best guinea pig. Hello, Paul."

As Hunter and his companion swept past, Anita commented, "She's stunning. "Who is she?"

"Australian friend of Paul's-he has some business in Queensland."

"So it seems."

"Darling-are we going to dance or talk? I'm running out of gas."

"Mrs. Kelly seems to be signaling to us-let's break off when we reach her."

A few seconds later, a little breathless, they came to a halt at the Vice-President's group. Bowman and Poole had now disappeared, but Kaminsky and Whitehead were talking animatedly with the Kellys.

"Hello, Miss Andersen," said the Vice-President. "I hope you don't mind us interrupting for a moment."

There was the very faintest of underlining to the "Miss", the Kellys were very old-fashioned, and like the rest of Washington knew perfectly well that Floyd and his lady were not particularly interested in matrimony. But they liked Anita, even if they did not altogether approve of her.

"Mr. Whitehead was telling us about your Council's report on extraterrestrial life forms, Heywood. He says you've worked out the design of a perfectly efficient creature. Is that really true?"

"I was referring," Whitehead said hastily, "to that last Rand Corporation study. But I don't think the Vice President altogether believed me."

Everyone laughed at this, for Whitehead's hobby had been well publicized. Though he was one of the world's experts on life-support systems, and had once, by miracles of improvisation, kept a team of six men alive on Mars for a week when they had lost their oxygen reserve, he was also extraordinarily imaginative and could have earned a good living as a professional writer. That he had published some excellent science fiction under the pseudonym "Paul Black" was an open secret, and he had been responsible for negotiating the serialization, book, film, and TV rights for the mission. It often seemed that he spent most of his time in the old Life building; there were rumors that he had been observed in the picket lines protesting the demolition of that venerable antique.

It took Floyd several seconds to recall the details of the study; he must have read-or at any rate skimmed-at least a thousand reports in the last couple of years, and they tended to blur together. The Space Agency was always issuing contracts to universities, research organizations, and industrial firms for astronautical studies. Sometimes the result was a thick volume of graphs or equations, and sometimes it was what one acute congressional critic had called "high-priced science fiction."

"As I remember," he said, collecting his thoughts rapidly, "the biologists asked themselves the question, 'If we had no preconceived ideas, and were starting with a blank sheet of paper-how would we design an intelligent organism?"'

"I'm not much of an artist," Floyd apologized, after he had managed to borrow paper and pencil, "but the general conclusion was something like this."

He sketched quickly, and when he had finished Mr. Kelly said, "Ugh!"

"Well," chuckled Floyd, "beauty lies in the eye of the beholder. And talking of eyes, there would be four of them, to provide all-round vision. They have to be at the highest part of the body, for good visibility-so."

He had drawn an egg-shaped torso surmounted by a small, conical head that was fused into it with no trace of a neck. Roughly sketched arms and legs were affixed at the usual places.

"Getting rid of the neck removes a fundamental weakness, we only need it because our eyes have a limited field of view, and we have to turn our heads to compensate."

"Why not a fifth eye on top, for upward vision?" asked Kaminski, in a tone of voice which showed what he, thought of the whole concept.

"Too vulnerable to falling objects. As it is, the four eyes would be recessed, and the head would probably be covered with a hard protective layer. For the brain would be somewhere in this general region-you want the shortest possible nerve connections to the eyes, because they are the most important sense organs."

"Can you be sure of that?"

"No-but it seems probable. Light is the fastest, longest-ranging carrier of information. Any sentient creature would surely take advantage of it. On our planet, eyes have evolved quite independently, over and over again, in completely separate species, and the end results have been almost identical."

"I agree," said Whitehead. "Look at the eye of an octopus-it's uncannily human. Yet we aren't even remote cousins."

"But where's the thing's nose and mouth?" asked Mrs. Kelly.

"Ah," said Floyd mischievously, "that was one of the most interesting conclusions of the study. It pointed out the utter absurdity of our present arrangements. Fancy combining gullet and windpipe in one tube and then running that through the narrow flexible column of the neck! It's a marvel we don't all choke to death every time we eat or drink, since food and air go down the same way."

Mrs. Kelly, who had been sipping at a highball, rather hastily put it down on the buffet table behind her.

"The oxygen and food intakes should be quite independent, and in the logical places. Here."

Floyd sketched in what appeared to be, from their position, two oversized nipples.

"The nostrils," he explained. "Where you want them- beside the lungs. There would be at least two, well apart for safety."

"And the mouth?"

"Obviously-at the front door of the stomach. Here."

The ellipse that Floyd sketched was too big to be a navel, though it was in the right place, and he quickly destroyed any lingering resemblance by insetting it with teeth.

"As a matter of fact," he added, "I doubt if a really advanced creature would have teeth. We're rapidly losing ours, and it's much too primitive to waste energy grinding and tearing tissues when we have machines that will do the job more efficiently."

At this point, the Vice-President unobtrusively abandoned the canape he had been nibbling with relish.

"No," continued Floyd remorselessly. "Their food intake would probably be entirely liquid, and their whole digestive apparatus far more efficient and compact than our primitive plumbing."

"I'm much too terrified to ask," said Vice-President Kelly, "how they would reproduce. But I'm relieved to see that you've given them two arms and legs, just like us."

"Well, from an engineering viewpoint it is quite hard to make a major improvement here. Too many limbs get in each other's way; tentacles aren't much good for precision work, though they might be a useful extra. Even five fingers seems about the optimum number; I suspect that hands will look very much the same throughout the universe even if nothing else does."

"And I suspect," said Kaminski, "that the people who designed our friend here failed to think far enough ahead. What's the purpose of food and oxygen? Why, merely combustion, to produce energy-at a miserable few percent efficiency. This is what our really advanced extraterrestrial will look like. May I?"

He took the pen and pad from Floyd, and rapidly shaded the egg-shaped body until the air and food intakes were no longer visible. Then, at waist level, he sketched in an electric power point-and ran a long cable to a socket a few feet away.

There was general laughter, in which Kaminski did not join, though his eyes twinkled.

"The cyborg-the electromechanical organism. And even he-it is only a stepping stone to the next stage-the purely electronic intelligence, with no flesh and-blood body at all. The robot, if you like-though I prefer to call it the autonomous computer."

"And what would that look like?" asked the vice-president.

Before Kaminski could answer, Whitehead annexed his sketchpad and started to draw swiftly.

"It could look just like one of our present computers," he said. "On the other hand-it could be this."

He handed the pad to Mr. Kelly. It showed a simple, unadorned tetrahedron.

"I see-TMA-l itself."

"Exactly, sir. There may be no pyramid-builders-there may only be pyramids. They may be our super-intelligences."

"That would be disappointing," said the Vice-President. "I don't know what I expect you to find out on Jupiter, but I hope it's more exciting than that."

"l don't," interjected Mrs. Kelly. Then she began to laugh.

After a while she pulled herself together, obviously with an effort.

"I've just had the most hilarious idea," she said. "Suppose you're right, and they send back an ambassador. Can you imagine that welcoming parade down Fifth Avenue- and the President sharing his Cadillac with a large, black pyramid?"

The Vice-President began to grin, and very quickly the grin spread right across his face. He made no comment, but everyone remembered the stories of his occasional disagreements with the Chief Executive.

It was quite obvious that he could imagine that parade; and that, on the whole, he rather liked the idea.

It was a glorious night; there had been rain earlier in the day, and the freshly washed sky was unusually dark. Bowman had never seen so many stars above Washington; and now, soon after midnight, the brightest of them all was rising in the east.

"Look, Mr. Vice-President," he said, as they took their final leave. "Our target-eight months from now."

They all stood in thoughtful silence, wholly forgetting the other guests, not even hearing the soft background of music from the band inside the house. Around them was the sleeping city, dominated by the floodlit bubble of the Capitol dome. And over that ghostly white hemisphere, Jupiter was rising.

MISS0N TO JUPITER

Like everything else in 2001, the good ship Discovery passed through many transformations before it reached its final shape. Obviously, it could not be a conventional chemically propelled vehicle, and there was little doubt that it would have to be nuclear-powered for the mission we envisaged. But how should the power be applied? There were several alternatives-electric thrusters using charged particles (the ion drive); jets of extremely hot gas (plasma) controlled by magnetic fields, or streams of hydrogen expanding through nozzles after they had been heated in a nuclear reactor. All these ideas have been tested on the ground, or in actual spaceflight; all are known to work.

The final decision was made on the basis of aesthetics rather than technology; we wanted Discovery to look strange yet plausible, futuristic but not fantastic. Eventually we settled on the plasma drive, though I must confess that there was a little cheating. Any nuclear-powered vehicle must have large radiating surfaces to get rid of the excess heat generated by the reactors-but this would make Discovery look somewhat odd. Our audiences already had enough to puzzle about; we didn't want them to spend half the picture wondering why spaceships should have wings. So the radiators came off.

There was also a digression-to the great alarm, as already mentioned, of the Art Department-into a totally different form of propulsion. During the late 1950's, American scientists had been studying an extraordinary concept ("Project Orion") which was theoretically capable of lifting payloads of thousands of tons directly into space at high efficiency. It is still the only known method of doing this, but for rather obvious reasons it has not made much progress.

Project Orion is a nuclear-pulse system-a kind of atomic analog of the wartime V-2 or buzz- bomb. Small (kiloton) fission bombs would be exploded, at the rate of one every few seconds, fairly close to a massive pusherplate which would absorb the impulse from the explosion; even in the vacuum of space, the debris from such a mini-bomb can produce quite a kick.

The plate would be attached to the spacecraft by a shock-absorbing system that would smooth out the pulses, so that the intrepid passengers would have a steady, one gravity ride-unless the engine started to knock.

Although Project Orion sounds slightly unbelievable, extensive theoretical studies, and some tests using conventional explosives, showed that it would certainly work- and it would be many times cheaper than any other method of space propulsion. It might even be cheaper, per passenger seat, than conventional air transport-if one was thinking in terms of million-ton vehicles. But the whole project was grounded by the Nuclear Test Ban Treaty, and in any case it will be quite a long time before NASA, or anybody else, is thinking on such a grandiose scale. Still, it is nice to know that the possibility exists, in case the need ever arises for a lunar equivalent of the Berlin Airlift....

When we started work on 2001, some of the Orion documents had just been declassified, and were passed on to us by scientists indignant about the demise of the project. It seemed an exciting idea to show a nuclear-pulse system in action, and a number of design studies were made of it; but after a week or so Stanley decided that putt-putting away from Earth at the rate of twenty atom bombs per minute was just a little too comic. Moreover- recalling the finale of Dr. Strangelove-it might seem to a good many people that he had started to live up to his own title and had really learned to Love the Bomb. So he dropped Orion, and the only trace of it that survives in both movie and novel is the name.

As has already been indicated by the frantic entries in my log, the story line took a couple of years of hard labor to pin down. We had the beginning and (approximately) the end; it was the center portion which refused to stay in one place. I sometimes felt that we were wrestling with a powerful and uncooperative snake, anchored at both ends.

FLIGHT PAY

The six members of the crew made their departures from Earth as quietly as possible, on separate and unannounced flights-some from the Kennedy Spaceport, some from the Baikonur Cosmodrome. They had all said goodbye to their families and friends, and had given countless interviews. They wanted no publicity during their last moments on Earth, and most of them managed to avoid it.

The actual launch date was still a week ahead. They would need all that amount of time to become accustomed to working and living as a team aboard Discovery under actual flight conditions-conditions which could never be completely simulated on Earth. The "Orbital Shakedown" could be carried out

safely yet realistically with Space Station One hovering only a few miles away ready to provide immediate help in case of emergency

That preflight week was also essential for medical reasons. As Dr. Poole expressed it, with concise accuracy, "It gives us a chance to share our germs." The ship would be rigorously quarantined; its inhabitants would catch no diseases from outside, and if they developed any allergies to each other, something could still be done about it.

There were countless little problems, but no major ones-at least, of a technical nature. However, Bowman was distracted from more important matters by one annoying piece of bureaucratic ineptitude

From the earliest days, the financial rewards of astronauts had always been the subject of controversy. Everyone agreed that they should be paid well-but how well?

After a long series of policy changes in which both the Space Agency and the individual astronauts had come in for much criticism, general rules had been worked out to everyone's satisfaction. On this mission, where every man except Dr. Poole was an Astronaut, First Class, all crew members would receive the standard basic pay for that grade, which worked out at $34,945 per annum. By special arrangement with the Federal Health Insurance Agency which had somehow got into the act, Dr. Poole's salary was supposed to be made up to that of his colleagues. For reasons that no one even attempted to understand, he actually received $35,105.

However-and this was where the trouble started-that was only the basic pay. On this mission there would be a flight bonus of $25,000 a year, as well as a substantial lump sum on return and provision for dependents in case of death or disablement. Bowman was just okaying the final payroll statements in the Administration Office of Space Station One when he noticed, quite by chance, that the flight bonus would not commence until the moment of injection into the transfer orbit to Jupiter.

The amount involved was only about $500 a man, but Bowman was quite sure that on earlier missions the full bonus had been paid from the beginning of the final checkout period in Earth orbit, when the full crew was assembled under captain's orders and the ship was in all respects operational - even though the flight had not actually begun. So he sent back a memorandum to Accounts, quoting precedents.

There is a type of civil servant (fortunately not as common as the critics sometimes maintain) who refuses to admit a mistake. Such a one appeared to be at the other end of the line. He refused to budge, and so did Bowman. So while the captain of the multi-billion-dollar Discovery was taking over command of his ship, he was conducting an increasingly astringent debate with an anonymous Washington bureaucrat for a $500 bonus. They were still shooting radio memos at each other when the voyage began.

DISCOVERY

To the sightseers, cameramen, and commentators aboard Space Station One, it was hard to tell that the ship was actually moving. There was, of course, none of the thunder and fury of a takeoff from earth as Discovery pulled out of her parking orbit; the only sign of acceleration was the unbearable, blue-white

radiance of the plasma jets blasting out their streams of ionized gas at hundreds of miles a second.

Even aboard the ship, the only sound produced by the drive units was a faint, far-off hissing, and their thrust was so low that weight was almost negligible. But they could maintain that thrust for hour after hour, as they spewed out their jets of star-stuff, hotter than the face of the sun. When they finally closed down, Discovery would be hurtling starward at almost thirty miles a second.

There was little for Bowman and Kaminski-acting as co-pilot-to do except to monitor all systems, and to be prepared to make decisions if a situation arose outside the computer's experience or programming. But Athena was working perfectly, measuring the ship's mounting speed and checking it second by second with the radars back on earth. From time to time she made minute corrections utterly imperceptible to the men aboard, to bring Discovery back onto the precomputed path.

Less than an hour after departure, she announced the uneventful passing of the voyage's first milestone. The announcement was for the benefit of the waiting earth, for the crew knew it already from their instruments, nevertheless, that cool, soprano voice filled them with many conflicting emotions:

"We have now attained escape velocity. I repeat: We have now attained escape velocity."

Here, already receding behind them, was what had once seemed the ultimate goal of rocket engineering. Whatever happened now, Earth could never call them back. Though power might fail in the next second, theirs would still be the freedom of space, to circle the sun forever on an independent planetary orbit.

There were still hours of acceleration ahead, but this was the psychological break-off point. Even though the cloud-girdled globe of Earth still filled the sky, she had lost them. Her backward- tugging gravity could now merely reduce their speed; it was no longer able to cancel and reverse it.

No man, however many times he went into space, could fail to react to this moment. His feelings depended on what he had left behind; for most, it was an instant of ineffable sadness, like the last sight of home to a seafarer who knows he will never return. For this was a parting that no men had ever experienced before this generation-a parting from the world more final than any earlier death, for Earth could not even reclaim their bones.

Soon afterward, the first booster unit was discarded. The acceleration ebbed to zero as the last precious drops of propellant were drained from the tank, and Discovery floated inert against the stars. Then the explosive bolts separated cleanly, and there was a gentle nudge as small solid rockets eased the two stages apart.

It was strange to see another manmade object hanging there in space, where a moment ago there had been only Earth, Sun, and stars. As the jets began to thrust again, the booster slowly dwindled astern; it seemed to be falling back to earth, but that of course was an illusion. It was now a satellite of the Sun, never to return to the world that had built it.

Three hours later, for the first time in the history of manned flight, Discovery passed another milestone.

"We have now attained solar escape," said Athena. "I repeat: we have now attained solar escape velocity."

At their control panels Bowman and Kaminski looked at each other with a mingling of pride and awe. Now they had not merely escaped from Earth, they had loosened the grip of the Sun itself. Unless they slowed themselves deliberately, they could now go sailing out past all the planets-gradually losing speed, but never falling back into the Solar System. In a few years they would pass the orbit of Pluto and go drifting onward, slowly but inevitably, toward the stars. It might take them a million years to reach the very nearest; but they would get there.

And still the speed mounted, minute by minute, through eight full hours of gentle acceleration. Earth was now a brilliant, waning crescent three hundred thousand miles sunward; though it was still a mere stone's throw away, astronomically speaking, it already seemed more distant than Jupiter. To Discovery's crew, it lay in their past, and they might never return to it. Jupiter lay in their future- and nothing, except the incredibly rare chance of a direct collision with a large meteorite or an asteroid, could prevent them from reaching it. For the ship was easing itself, with exquisite precision, into the final orbit.

"One minute from injection," said Athena. "Cutting main drive in ten seconds."

Par away, the barely audible hissing of the jets died into silence. With their passing went also the last sensation of weight, except for occasional ghostly pats and nudges as the low-powered vernier jets made infinitesimal adjustments to the orbit. Soon even these were finished; and Athena announced: "On course for Jupiter. Estimated transit time two hundred nineteen days five hours."

THE LONG SLEEP

Every day the Sun was two million miles farther away, and the Earth was no more than the most brilliant of the stars. Discovery was hurtling effortlessly out into the night, her drive units quiescent, but all her other systems functioning at full efficiency.

This was the final shakedown period, when the crew would acquire the skills that could never be learned on Earth, or even in free orbit. One by one they crosschecked each other's performances, studied all that was known or suspected about their still-distant goal, and reacted to simulated disasters.

Of these, the most feared were fire and meteorites. Even more than a ship of the sea, a ship of space is vulnerable to fire. It contains great stores of concentrated energy-chemical, mechanical, electrical, nuclear-any of which may be accidentally unleashed. Every other day, at unexpected times, Bowman would hold a fire-control exercise, and all the heat-sensing alarms were tested with almost fanatical regularity.

As for meteorites, one could only hope for the best and put one's faith in statistics. Complete safety was impossible; every day, many thousands of dust particles would bombard the ship, but the vast majority would be so tiny that

the mark they made on the outer skin could be seen only through a microscope. The few that did penetrate would be stopped by the inner hull.

If everything went completely according to plan, there would be no need for even a single member of the crew to stay out of hibernation until Jupiter was reached, Athena could attend to all the running of the ship. On a seven month voyage, however, the unexpected was bound to happen; hence it was wise to have a man available at a moment's notice.

And any man, no matter how stable and well balanced, needed a back-up at least as badly as did Athena. Otherwise, the sense of isolation might overpower him, and he would move into that realm of inhuman detachment that had in the early days of astronautics, caused so many accidents.

The psychologists disliked the term "break-off," because it gave the impression of abruptness; but the name had stuck. The first men to fly alone in high-altitude balloons, and the pioneer explorers of the underwater world, had experienced the phenomenon as long ago as the 1950's. It was a sense of remoteness, and of total separation from everyday life, which was not in the least unpleasant. Indeed, it could be positively exhilarating-and that was its greatest danger; for in extreme cases, it could lead to delusions of omnipotence. Divers had been known to swim from deep bases without their breathing gear; astronauts had ignored the plain warnings of their instruments. Some had escaped the consequences of their rashness; many had not.

The cause of break-off was usually sensory deprivation; robbed of the normal flow of messages from all its inputs the ever-active brain started to build its own world, which seldom coincided with reality. The cure was simple; if a man was kept busy on assigned tasks, and was in continual communication with his colleagues, he was in little danger.

So Bowman had to have a deputy, and the obvious choice was Peter.

Whitehead sometimes called himself "Engineer in charge of everything else." Another of Whitehead's favorite sayings was that every problem had a technical solution-it was just a matter of choosing the best. His genius for trouble-shooting was probably another aspect of his highpowered imagination, for he seemed able to identify himself with recalcitrant machinery. There were some who claimed that he had paranormal powers, for whereas most engineers had to kick their black boxes when they misbehaved, Whitehead merely had to glare at them.

On the tenth day, at last satisfied that the ship was running flawlessly, Bowman called a final crew conference. Anyone looking at the six men gathered on the control deck could have divided them at once into two categories. Bowman and Whitehead were in good physical shape, whereas the other four were sleek and plump. There had been many jokes about condemned men eating hearty breakfasts, and cattle being fattened for the slaughter. But the low-residue, high-calorie diet was an essential preparation for the long sleep; some fuel was necessary, even at the low metabolic level of hibernation. When they awoke in little over half a year, most of this fat would be gone.

And so would Earth, that brilliant star now dominating the sky. The next time the four sleepers opened their eyes, their home planet would be lost against the glare of the Sun; and Jupiter would be lord of the heavens.

It was a solemn moment, this parting of the ways; no one felt like making any of the usual wisecracks, for all knew that they might not meet again. And the

men who were about to hibernate, though they had been through this before, and thoroughly understood its necessity, were reluctant to go. Any one of them would have changed places with Bowman or Whitehead.

"This is for the record," said Bowman, a little self-consciously, glancing out of the corner of his eye at the TV camera which surveyed the Control Center, and which continually reported the situation to Earth. At this close range it was still operating in real time; out at Jupiter, it would be sending only one frame a second-but that was quite adequate for monitoring purposes.

"All the scheduled checkouts have been completed; there have been no unexpected problems. We are now at Day 10, which is the time planned for hibernation to commence. It is my opinion that we should continue according to program. If any of you disagree, please say so now."

There was a rather restless silence. Everyone seemed waiting for someone else to speak, but no one did. And no one knew that Dr. Poole, who had secret orders of his own, was carefully watching both Bowman and Whitehead for any signs of disturbance. He was satisfied by what he saw.

"Very well," continued Bowman. "You all know what to do. As soon as you're ready, please call Doc."

It was all very crisp and impersonal and businesslike, but the individual good-byes would not take place under the gaze of the TV camera. One by one, Kimball and Hunter and Kaminski and Poole drifted back to their cabins in the carousel, and put their few belongings in order. And presently each one spoke privately over a radio circuit to Earth, and for the only time on the voyage the ship's recorders were shut off, while verbal farewells were transmitted. To most of them this was an ordeal they would have preferred to avoid, and they were secretly glad that there could be no direct reply. By this time, the round-trip radio delay was over two minutes, and a conversation with Earth was impossible.

At the last moment, Poole made the final tests of the men he would soon be following into sleep. To each, Bowman delivered appropriate versions of the same rather forced jest: "You lucky bastard! Pete and I will be working like dogs for seven months, while you take it easy." Then the electronarcosis currents started to pulse, and Discovery's operational crew diminished to five, to four, to three....

"That's it," said Dr. Poole. "All sleeping like babies." He looked at Bowman with a serious, thoughtful expression; they were alone together, while Whitehead stood watch on the control deck. "How do you feel?" he asked.

"A little tired, but very glad it's gone so smoothly. Don't worry about us, Kel. The first time we cut our fingers, or feel colds coming on, we'll wake you up."

Poole chuckled. "You make me feel like an old-time country doctor, wondering whether the telephone will let him have an undisturbed night. O.K.-do your stuff."

Bowman adjusted the biosensor straps around Poole's chest and right arm, checked the head bands carefully, and triggered the high-pressure hypodermic. There was a brief hiss as the drugs were forced into Poole's bloodstream.

"Happy dreams, Doc," said Bowman.

"Be seeing you," answered Poole. He started counting: "One ... Two ... Three...." but got no further.

For a moment, Bowman stood looking at his sleeping friend, half envious of his freedom from responsibility. Then, with quite unnecessary quietness, he tiptoed away and went to join Whitehead at Control.

He found his shipmate staring, with undisguised fascination, at the four little panels on the situation display board marked KAMINSKI, KIMBALL, POOLE, HUNTER. Each showed a small constellation of green lights, indicating that all was well.

And on each was a tiny screen, across which three sets of lines traced leisurely rhythms, so hypnotic that Bowman also found it hard to tear away his eyes. One line showed respiration, another pulse, another EEG.

But the panels marked BOWMAN and WHITEHEAD were blank and lifeless. Their time would come a year from now, out at the orbit of Jupiter.

RUNAWAY

To Bowman, the first intimation of trouble was a quiet voice saying over the open radio circuit. "Dave-I'm having control problems." Whitehead sounded slightly annoyed, but not in the least alarmed.

Before Bowman could answer, he saw the pod emerge from the shadow of the ship, only twenty feet beneath the main observation window. It was under full power, heading roughly along the line of Discovery's orbit.

"What's the trouble?" he called. For a few seconds there was no answer, and the pod was already a hundred feet away before Whitehead replied.

"Throttle jammed at full thrust," he said, quite calmly "I'm building up a little distance before I try anything."

That made sense, a runaway pod needed plenty of space to maneuver. And there was still no cause for real worry; Bowman was quite sure that Whitehead would soon fix the trouble, as he had always done in the past.

The seconds ticked slowly by; the pod was still gaining speed-and now it was so far away that it was barely recognizable. Though Whitehead would have no difficulty in homing on the ship from a distance of many miles, he had better not leave matters until too late for his main drive would empty the propellant tanks in a very few minutes.

The pod was now a tiny spot, its distance impossible to judge by the eye. Bowman locked the navigation radar on it, and was surprised to find that it was still only two miles away. But, far more serious, it was already traveling at a hundred and ninety miles an hour.

"Peter!" cried Bowman. "What the hell's happening? Can't you fix it?"

For the first time, there was a note of alarm in Whitehead's voice.

"Controls won't respond," he said. "I'm pulling the main fuse to cut off power. Call you back."

A second later, his radio went dead. While waiting, Bowman searched for the pod with a telescope, and found it quickly enough. With a sinking heart, he saw the little cloud of mist flaring from the rocket nozzle, and knew that the capsule was still accelerating.

Whitehead was back on the air almost at once.

"No use," he said abruptly. "Trying to turn with auxiliaries."

It was a tricky maneuver, but the obvious next step. Even if he could not turn off the main drive, he should be able to spin the pod around so that he reversed the direction in which it was building up its uncontrollable velocity. Then the runaway would eventually be brought to rest, and presently it would start coming back again.

Tense and pale, with a dreadful feeling of helplessness, Bowman stared through the telescope. In its field of view, the pod seemed only a few feet away, and he could see every detail of its construction. Then, to his enormous relief, little spurts appeared from the attitude-control nozzles, and the capsule began to turn slowly on its axis.

The treacherous main drive swung out of sight, still firing, next he had a broadside view-then he was looking straight into the bay window at the seated figure of his friend. He could have seen Whitehead's expression, if it had not been for the glare of reflected sunlight on the transparent panels.

"You've done it!" he cried. "Thank God!"

The capsule was still racing away at over two hundred miles an hour-but at least it was now losing speed, no longer gaining it, as its jet acted as a brake.

"Looks like it," said Whitehead, his voice showing his immense relief. "I knew Betty wouldn't let me down, if I treated her properly."

Though it seemed ages, it was less than a minute before Bowman could tell, even without the aid of radar, that Whitehead was on the way back. Presently the capsule began to grow in the field of the telescope-slowly at first-then rapidly-then too rapidly.

"Still can't cut the damn thing," said Whitehead. "Hate to waste all this fuel, but I'll just have to swing to and fro until I run out of gas."

It seemed to Bowman that the capsule was now heading straight toward the ship; they were out of the frying pan and into the fire. The risk of losing Whitehead had now been replaced by an even more serious danger.

"Watch your track," he called anxiously. "I think you're on a collision course."

"I know," said Whitehead breathlessly. "Trying to flip her around again."

He was too late. For one hideous moment, the capsule seemed to be heading straight for the observation windows of the Control Deck. Then, barely in time, the steering jets opened up, and the runaway vehicle skimmed above the curving hull of the ship and behind Bowman's field of view.

"Sorry about that," said Whitehead. "Give you a wider berth next-"

The sound of the crash came simultaneously over the radio and through the fabric of the ship. Bowman half rose from his seat, waiting for the alarms to go and for the damage signals to start flashing. But nothing happened; it must have been a glancing impact-no real harm done. To Discovery, at least; but what about the capsule?

"Peter!" he called. "Are you all right? Do you read me?"

There was no reply. Bowman turned the gain of the radio full up, and listened intently. The carrier wave was still coming in, but that proved very little. He had hoped to hear the sound of Whitehead's breathing, even if he had been knocked unconscious. If the capsule had been cracked, of course, there would be no breathing-and no sound, except for the muffled roar of the jet drive, as loud as ever through the metal framework of the runaway.

That roar was still audible over the radio, but there was nothing else. Bowman called again, and again, Whitehead did not reply. At the same time, he swiftly ran through the pictures on the rear- view monitors, and after a quick search located the capsule a few hundred yards away.

To his great relief, it appeared intact-but it was still under power. Whether he was dead or alive, it was carrying Whitehead inexorably away from the ship; and there was nothing whatsoever he could do about it.

"Peter!" he called. "Peter! Can you hear me?"

Still no answer-only that maddening jet roar. It seemed to last forever; and then, suddenly, it stopped. The capsule had at last used up its fuel.

Once more, Bowman strained to detect the sound of breathing over the hiss of the carrier wave. The microphone was only a few inches from Whitehead's mouth; if the space pod still contained air, he should hear something....

He did, and with a sigh of relief he resumed his own breathing. First there were some soft bangings, then a mumbled exclamation like a drunken man talking in his sleep. That was followed by a short blast of well-organized profanity; Whitehead was wholly conscious again.

"Hello, Dave," he said, even before Bowman could call him. "I'm O.K. now-just a bruise on my forehead-no other damage. Will you get a fix?"

A quick glance at the radar showed Bowman that the capsule was still less than five miles away. That was a perfectly trivial distance-but it was increasing rapidly. For despite its periods of braking, the pod was now racing away from Discovery at three hundred and sixty miles an hour.

Every minute it would increase its distance by six miles- and so on, hour after hour, day after day. But before long, of course, this would be of no practical interest to Peter Whitehead.

Bowman reported the facts; then he asked quickly: "What's your oxygen reserve, Pete?"

"About . . . five hours."

"Only five?"

"Yes. It was a single-tank job-so I thought."

Bowman did not say what had flashed through his mind, but he was sure that it had already occurred to Whitehead. No matter how much oxygen the pod carried, it might make no difference now.

For several seconds there was no sound over the radio circuit; then Whitehead said, with a kind of resigned sadness: "Well, I guess that's it, Dave."

"I'm damned if it is. I'm coming out to catch you. Hold on."

There was another pause, before Whitehead replied: "You can't do that-not enough safety time, anyhow. You know you can't leave the ship."

"I bloody well can; Athena can handle things. I'm coming."

"Let's not fool ourselves. What was that velocity vector?"

"Five hundred thirty feet a second."

"Give that sum to Athena, if you like. I know the answer already." So, in his heart, did Bowman. If he risked abandoning the ship and his four sleeping companions, he could eventually catch up with Whitehead. But then they would both be several hundred miles from Discovery-and still moving away from her at that deadly five hundred thirty feet a second. The rescue pod would first have to cancel that speed, and not until then could it start on the return journey. With that extra payload, it could never make it home.

Nevertheless, Bowman fed the figures to Athena. The answer came back instantly: IMPOSSIBLE.

Just for a moment, before his years of training asserted themselves, he was overcome by a sense of blind rage, and wanted to hammer his fists against the cold display panels of the computer. But that would be no help to Whitehead or to himself. It was impossible to argue with the laws of mathematics, and stupid to feel anger at them. If one chose to live by the implacable equations of the Universe, then when the time came one must also die by them.

But he refused to admit defeat; men did not give up as easily as this. He remembered Whitehead's own favorite saying: "Every problem has a technical solution." There must be a solution for this problem, if only he could think of it.

The situation was so absurd, so utterly ironic. Here he was in a ship that could cross half a billion miles of space and travel at thousands of miles an hour-and he could not save a friend drifting slowly to his death a mere ten miles away. If he returned to Earth, who would ever understand his terrible dilemma? Always there would be the unspoken question: "But surely you could have done something?''

But this was no TV space opera, where the hero conjured some brilliant answer out of his hat. This was a problem for which there was no solution.

"Dave," said the loudspeaker suddenly. "Can the ship do anything?"

Though Whitehead was not a propulsion expert, he certainly knew better than this. The very fact that he had asked such a question indicated some loss of self-control, but Bowman could hardly blame him. A desperate man would clutch at any straw.

"I'm sorry, Peter," he answered gently and patiently. "You know the main reactor has been shut down and the thrusters have all been mothballed. It takes over a day to test them and run them up."

And even then, he might have added, it would not have helped. The ship's acceleration was so low that it could never overtake the pod before the five hours were up.

That was going to be the longest five hours in Bowman's life.

FIRST MAN TO JUPITER

And then while Bowman was still considering his next move, Whitehead asked an extraordinary question.

"Dave," he said, in a curiously flat voice, "Are there any asteroids close to us?"

"Not according to the Ephemeris. Why?"

"Unless I'm crazy, there's something else out here- only a few miles away."

Bowman's first reaction was one of surprised disappointment. He had not expected Peter to start cracking up so soon, but perhaps that blow on the head had produced aftereffects. Not for a moment did he credit the report; space was so inconceivably empty that a close passage by any other object was almost a mathematical impossibility. Whitehead could only be suffering from hallucinations; it would be best to humor him.

But that thought had already occurred to Whitehead himself.

"No-I'm not seeing things," he said, almost as if he was reading Bowman's mind. "There it is again-it's flashing every ten or fifteen seconds. And it's definitely moving against the star background-it can't be more than five or ten miles away."

"Can you give me a bearing?"

Bowman still did not believe a word of it, but he started the wide-scan radar-and almost at once his jaw dropped in astonishment.

There was Whitehead's echo, now at twenty-two miles. But thirty degrees away from it, at considerably less range, was a far larger one.

"Christ!" he exclaimed, "you're right! And it's bloody enormous. Let me get a scope on it."

As he fed the radar coordinates to the telescope, and waited for the instrument to swing to the right quarter of the sky, his mind was a tumult of conflicting emotions. Perhaps they were both hallucinating; looked at dispassionately, that was the likeliest explanation.

And then, just for a few comforting seconds, a naive wish-fulfillment fantasy flashed through his mind. They were not alone; there was another ship out here, arriving to rescue Whitehead in the nick of time.... It could not, of course, be a ship from Earth; it could only be-

The star images stabilized. There in the center of the field was, without any question, something large and obviously artificial, glittering metallically as it turned slowly in the sun. With fingers that trembled slightly, Bowman zoomed up the magnification.

Then the fantasy dissolved, and for the first time he realized the full extent of the disaster that had overwhelmed the expedition. He knew now why none of the alarms had sounded when Whitehead's capsule had collided with the ship. In missing the hull, it had hit a target that was almost equally vital.

Receding there behind them, still spinning with the force of the impact, was the entire long- range antenna complex. The big forty-foot-diameter parabola, the smaller dishes clustered around it, the gear designed to aim their radio beams across half a billion miles of space-all were drifting slowly back toward the sun.

The runaway capsule that had doomed Peter Whitehead had also destroyed their only link with Earth.

"Funny thing," said Whitehead, as he passed the six hundred-mile mark, "but there are no messages I want to send, anyhow. I made all my goodbyes back on Earth; I'm glad I don't have to go through that again." He paused, then added; "There was a girl, but she told me she wouldn't be waiting. Just as well."

There was a curious detachment and lack of interest in Whitehead's voice. Already, it seemed, he was drifting away from the human race in spirit as well as in body. Perhaps the defensive mechanisms of the mind were quietly coming into play, extinguishing the fires of emotion, as the engineer of a sinking ship will close down his boilers lest they cause a last-minute explosion.

Presently he said: "I wish I could see Earth; a pity it's lost in the sun. But Jupiter looks beautiful; it seems so close already. I hope you make it-I hope you find what you're looking for."

"We'll do our best," answered Bowman, swallowing hard. "Don't worry about that." He wondered if Whitehead realized that he had said "you," not "we." Consciously or unconsciously, he had already removed himself from the roll call of the expedition.

The leaden minutes ticked slowly away, while Bowman waited with mingled grief and frustration. If Whitehead wished to be left to his own thoughts, so be it; he was not going to engage him in light chatter at moments such as this.

The radio circuit to the capsule was still heartbreakingly dear; there was no sense of distance or separation. Over such a trivial span of miles, the low-power transmitter in the Control Center was perfectly adequate. Though it was designed for communication with space pods working in the immediate vicinity of the ship, it had more than enough range for this task.

Then Whitehead said, quite unexpectedly: "There's one thing I'd like you to do for me, Dave."

"Of course."

"Play some music-something cheerful."

"What would you like?"

"The Pastoral, I think. Yes, that would do nicely."

Midway between Mars and Jupiter, two tiny, and slowly separating, bubbles of warmth and light began to reverberate to the sounds of spring. When the symphony had run its course and ebbed into silence, the pod was more than a thousand miles away.

It was still quite clearly recognizable in the telescope, though its finer details could no longer be seen. Every day, it would draw eight thousand miles further ahead of Discovery, and though its future position could be predicted to the end of time, it would soon be lost against the background of the stars.

"Dave," said Whitehead suddenly, "can you still hear me?" His voice sounded more animated-less remote and detached. It was as if he had made some decision, and was no longer drifting helplessly.

"I read you loud and clear."

"There's a job I still have to do. I want to find what went wrong. It won't make any difference now-but it may help someone else."

That thought had already passed through Bowman's mind, but he wanted the suggestion to come from Whitehead. He felt an absurd impulse to say "Be careful!" and managed to fight it down.

"What do you think happened?" he asked instead.

"I was in shadow for thirty minutes on that last job, and I noticed it was getting very cold; the heater system must have gone on the blink. Nothing really serious-but perhaps the cold cracked one of the pipelines. I guess there was a leak; some propellant may have got out, and then frozen on the controls. I still don't see how it was possible, but it's the only theory that makes sense. Anyway, I'm going out to check it. I have thirty minutes of air in this suit. I'll call you back as soon as I've depressurized the capsule."

"I'll be listening out," said Bowman. He found it very hard to say anything-even to make the simplest responses. The feeling of utter helplessness and inadequacy still overwhelmed him; the sense of loneliness would come later.

He knew exactly what Whitehead was attempting to do. When he had depressurized the capsule, he would open the hatch and work his way, hand over hand, around to the propulsion unit at the rear. It would not be hard for him to take off the protective covers, and perhaps he could see what had gone wrong. It was not very likely, but it was worth trying. And certainly it was better than waiting passively for the end.

One minute-two minutes-went by. Surely he had made the trip by now!

"Peter-have you found anything?" Bowman called at last.

There was no answer. He called again, and again.

Then he began to wonder. Perhaps something had gone wrong-but if so, was it really an accident this time?

Once more he called out into the unreverberant silence, but already he was certain that he would never know the answer.

There were times when the greatest heroism consisted of dying quietly, without making a fuss. This Peter Whitehead had done; no one could ask for more.

And two months from now, a million miles ahead of his comrades, he would be the first of all men to reach Jupiter.

THE SMELL OF DEATH

Hours ago, Bowman knew very well, he should have awakened his back-up. But while Whitehead was still alive, he had not the heart to do so; it would have been too final an admission of hopelessness. Now he would delay it no longer, for his own peace of mind as much as for the safety of the ship. He felt a desperate need to hear a human voice again; never before had he realized so dearly that man was a social animal, and could not long survive in isolation. And no man before, since the beginning of history, had known such isolation as this.

Bowman made his way slowly through the silent passageways; somehow the ship already seemed empty, like a deserted house. He drifted down the axis of the carousel, and when he was gripped by its centrifugal field the sudden return of weight almost made him collapse. Though he wanted to lie down and rest, if he gave way to this impulse he did not know when he would wake again. He was the ship's only human guardian now; he could not sleep while he was still on duty.

Luckily, the revival procedure was automatic, there was nothing he had to do, no stages where he could make an error through tiredness. Once he had given Athena her orders, she would carry them out with superhuman infallibility.

In Kelvin Poole's room all was cold and silent, as it had been for the last five months. The biosensor display was normal; respiration, body temperature, blood pressure, heartbeat were all inside the safety limits. And according to Athena, who alone could interpret it, the EEG was also satisfactory for a hibernating man.

Bowman broke the seal on the REVIVAL switch, pressed the button, and waited. First, the electronarcosis current would be switched off. There was no apparent physical change in the sleeping man, but at once the dancing waves of the EEG display increased in amplitude and became more complex. Slowly, and perhaps reluctantly the brain of Kelvin Poole was turning back from the world of dreams.

Two minutes later, Athena triggered the hypodermic strapped to Poole's forearm; Bowman could hear the tiny hiss as high-pressure gas forced the stimulants through the skin. Now he should see the first reaction, normally it came in about thirty seconds.

He was not worried when nothing happened for well over a minute. Then Poole's eyelids started to flutter, and he gave a slow yawn. His diaphragm began to heave with normal respiration, and he rolled his head slightly to the side.

A minute later, he opened his eyes, and stared vacantly through Bowman, like a newborn baby still unable to focus upon the external world. But presently awareness came into his gaze, and his lips began to move. It was impossible to hear what he was saying, if indeed he had enunciated any words at all

"Take it easy, Kel," said Bowman. "Everything's O.K." He only wished that this were true.

Again Poole's lips moved, and now his voice was just audible as a faint sibilation, producing no intelligible sounds. At the same moment, Athena spoke.

"Poole cardiogram abnormal. Recommend injection H.6."

Bowman grabbed the hypodermic from the emergency medical kit. He fired it into Poole's arm, then anticipating the worst, broke out the autorespiration mask and its attached oxygen cylinder.

But the shot seemed to be working. Poole was obviously quite conscious, though his chest was heaving erratically. He looked straight at Bowman, and his lips began to move again. At last he spoke-only two words, laden with sadness and regret, banishing all hope with their finality.

"Goodbye, Dave."

Bowman's paralysis lasted little more than a second: it was broken when Athena's calm, impersonal voice announced:

"All systems of Poole now No-Go. It will be necessary to replace him with a spare unit."

"Shut up, damn you!" yelled Bowman, as he clamped the mask over Poole's face and switched on the oxygen. The gas began to pulse through the plastic tubes, the noise it made sounding like a horrible parody of human breathing. Though he knew that it was no use, he continued until the oxygen was exhausted, and all the biosensor displays showed flat, featureless lines.

Kelvin Poole lay calm and quiet again; it was impossible to tell that he was no longer in hibernation. But to David Bowman, commander of the only ship beyond the orbit of Mars, it seemed that the gently circulating air around him already carried the smell of Death.

ALONE

Bowman did not remember leaving Poole's spinning tomb in the carousel, but now he was back on the Control Deck, looking out at the unchanging stars. He was in a state of shock, going about his business like a machine, and hardly aware of any emotion. Though he felt unutterably tired, it seemed that he could carry on forever, as sleepless as Athena, while there was still work to be done and decisions to be made.

Tragedy had snowballed into disaster; what had now happened could be far more serious than the loss of Whitehead. Poole's death might be another accident, or a piece of sheer bad luck that would never occur again. But if something was fundamentally wrong with the revival process, his sleeping shipmates were already doomed. And he with them; for he could not handle Discovery alone, when the time came to steer her into her final orbit.

This was not a situation anyone had been pessimistic enough to imagine; no procedure had been laid down to deal with it. When some utterly unexpected problem arose, his orders were to consult with Earth, if time permitted. He had the time; no one had ever dreamed that he would lack the ability. For if any part of the radio equipment failed, it could always be repaired or replaced; the only item that had not been duplicated, because of its size and weight, was the antenna assembly. Who would have imagined that anything could ever demolish that system, short of wrecking the ship itself? It was not, in the jargon of the designers, a credible accident; but it had occurred.

The loss of the antenna had not only made it impossible to obtain medical advice from Earth; it had endangered the whole purpose of the mission. Whatever they might discover when they reached Jupiter, they would have no way of reporting it home.

There was one slim chance of saving the situation. The antenna was not many miles distant and traveling away from the ship at a relatively low speed. He might be able to retrieve it and effect temporary repairs; even if he could not do so, perhaps Kimball and the others would succeed-as long as he recaptured the lost equipment before it was forever out of reach.

He took careful measurements of speed and velocity with the ship's radar, then made estimates of the mass that was now drifting away into space. He fed the information into Athena, set up the problem, and watched the answer flash on the display before he could even lift his finger from the keys.

Yes, a fully fueled and provisioned pod could do it, if he acted now and if everything went smoothly. But time was fast running out; the chance of success diminished with every passing minute. If he did not leave within the next few hours, the operation would be impossible.

Like most space missions, it involved subtle trade-offs between time and speed and payload, and the answer was not at all obvious. Merely to get to the drifting antenna was easy enough; the pod could make the round trip in four or five hours-if it had nothing else to do. But Bowman had to hold in reserve a substantial portion of his total fuel for the task of slowing down the runaway equipment, and then turning it back toward the ship. This drastically reduced the overall performance of his little vehicle, by limiting the speed it could obtain. The outward trip would take five hours, the return run another five- and the capsule carried oxygen for only twelve hours.

Two hours to grapple the antenna and reverse its velocity; that seemed an adequate margin of time, though he would have preferred more. He was well aware of the risks, but they were not so great that a reasonable man would be deterred by them. Whitehead's mishap would not occur again in a million hours of operational time; the worst dangers were those of carelessness, for space was pitilessly unforgiving of mistakes. And though he would be leaving the ship without a human watcher at the controls, Athena could handle the situation. If he did not come back, in a few hours she would awaken the next man. He was not endangering his sleeping colleagues; indeed, he was increasing their chances of life, and of completing the mission successfully.

When he had satisfied himself that there was no flaw in his logic, he entered his decision in the log. Then, swiftly but conscientiously, he made his preparations to leave the ship. He was not going alone, for he had a second task to perform.

He had also to consign Kelvin Poole to the deeps of space.

Space capsule Alice hung in the airlock, holding her somber cargo in her mechanical arms like a robot Pieta. Bowman had checked and double-checked her systems: he was ready to go.

"Mary Sarah Alice," he ordered Athena. "Pumping sequence start."

"Mary Sarah Alice," Athena should have echoed. "Pumping sequence start." But she did nothing of the sort.

Her immediate response was a sound that Bowman had never heard before, except during practice runs. It was a high-pitched PING-PING-PING, completely distinctive and quite unmistakable. He knew exactly what it meant, but in case he had forgotten, Athena reminded him.

"Order violates Directive Fifteen," she said. "Please cancel or amend."

Bowman cursed silently. It was no good arguing with Athena, she had her instructions-her built-in laws-and she would obey them. This was something he should have remembered, and the error was alarming, though understandable in the circumstances. He was very tired and under a great strain; what else might he also have forgotten?

He could not leave the ship, if there was no deputy commander to take over from him. Athena knew the present state of affairs; it was no use trying to fool her. She would not let him go-and, without her cooperation, he could not even open the airlocks.

It was a maddening situation, and illustrated perfectly the lack of initiative shown by even the most advanced computers. He had spent almost an hour with Athena analyzing this mission, and not once had she reminded him that he could not carry it out....

The captain of the Discovery was a stubborn man, particularly when he was frustrated. He looked at his chronometer; there was still plenty of time. Then, angry at Athena and at himself, yet coolly determined on his plan of action, he climbed out of the capsule, shucked off his spacesuit, and returned to the Control Deck.

The laws governing Athena's behavior were not inviolable; like any computer, she could be reprogrammed. But this was a skilled job, and it took time. When Bowman had consulted the logic diagrams, decided which steps could be cut out, checked that he had not introduced undesired side-reactions, run the new program through several times, and corrected a number of trivial mistakes, he had wasted more than an hour. Yet this was one operation that certainly could not be hurried; if the revised program was faulty, Athena might let him out of the ship-but she might not allow him to return.

Before he left the Control Center, he checked the position of the drifting antenna once more, both visually and by radar. It was now considerably further away, and when he recomputed the mission he was alarmed to find that he would have only about an hour of working time when he caught up with the runaway hardware. But that should be sufficient, all he had to do was to make contact with the antenna and push it gently back toward the ship. It seemed a straightforward enough operation, and he did not anticipate any difficulty.

There were no protests from Athena, and no further delays in the airlock. At his command, the door swung open into space.

Like a tiny, complex toy, surrounded by stars and the distant glow of the Milky Way, Discovery hung in space between Mars and Jupiter. She seemed absolutely motionless, not even rotating, but in reality she was still leaving the Sun at almost a million miles a day. The tiny, shrunken Sun, whose pale rays had long lost the power of bringing warmth.

One might have watched the ship for hours, even for days, and seen no sign of life. Yet now a black circle had appeared in the hull, as a door swung out into nothingness. From that circle slowly emerged the glittering, ungainly shape of a space capsule. Bowman and Poole were leaving Discovery.

With great difficulty Bowman had sealed Poole into his suit, for he did not wish to see the transformation which the body of an unprotected man undergoes in a vacuum. It was an extremely expensive coffin, this armor that had been built to guard him in life. But it was of no use to anyone else; it had been tailored to fit Poole, and now would perform this last service for him.

He set the timer for a five-second burst, and punched the firing key. With a faint hiss, the jet burst into life; he felt the momentary surge of weight as the pod's seat pressed against him with its fifth-of-a-gee acceleration. Then it was over-but he was moving away from Discovery at twenty miles an hour.

For one horrible instant, it seemed that the metal hands of the space pod had become entangled in the harness of the suit, but he managed to get them loose. Then the body was floating beside him, no longer in contact, but still sharing his speed as they both drifted away from the ship.

And now Kelvin Poole was following the road along which Peter Whitehead had already traveled. Both of them, in strange and literal truth, were on their way to the stars. For they were moving fast enough to escape from the Solar System; though they would sweep past Jupiter, even its giant gravity could never capture them. They would sail onward through the silence, passing the orbits of the outer planets one by one; and only then would their journey really begin-a journey that would never end, and might outlast Earth itself.

It was well that David Bowman had other work to do; he had no time for sorrow or regret. With great care, he aimed the pod toward its goal, now more than five hundred miles away, and signaled for the calculated twenty-five seconds of firing time.

He was only a quarter of a mile away, but moving at over a hundred miles an hour, when the period of powered flight ended. Discovery already looked too small and remote for comfort, she would soon grow smaller still. About a thousand feet from the ship, a just-identifiable package was hanging in space, apparently motionless. But Bowman knew that it was traveling steadily outward, and that when he returned Kelvin Poole would no longer be in sight. Now there was nothing he could do, except sit and wait for five hours while Alice coasted to her destination.

After a few minutes, he had to look hard to find Discovery; she was a rather dull star, easily lost against her more brilliant companions. Before the voyage was half completed, he could no longer see her with the unaided eye, and he was glad that he had programmed Athena to send him a regular situation report, running through the main instrument readings over and over again. That calm

voice quoting temperatures and pressures and radiation levels was an assurance of normalcy and stability in me little world from which he had temporarily exiled himself. He might have chosen music, but had decided against it: it would have reminded him too closely of Whitehead's last moments.

When Discovery was no longer visible, he tried to concentrate on his destination; though the drifting antenna was easy enough to locate by the capsule's radar, and he knew the exact moment when he would intercept it, he nevertheless felt a surge of relief when he saw one star becoming brighter in the sky ahead. Soon he could make out the details of the structure-and then, quite suddenly, it was time to decelerate, with another twenty-five-second burst of power.

He brought the pod almost to rest while it was still a hundred yards from the antenna, for he dared not risk damaging it by his jet blast. As he drifted slowly toward it, he studied its condition, and planned his line of attack.

The six delicate, curving rods of metal that formed the main elements of the parabolic dish were shaped like the ribs of an umbrella, and were almost as fragile. They were covered by a fine, metallic net, that looked quite beautiful as it sparkled in the sun like a giant spider's web. Around the rim of the parabola smaller antennas sprouted; some of them had snapped off and hung dangling in space. One of the main ribs had also been broken, but on the whole there was surprisingly little damage.

At the center of the big dish was the universal joint mechanism which could aim it with fractional- degree accuracy to any quarter of the sky; about ten feet of supporting mast, snapped cleanly, and trailing wires and cables, was attached to this. The initial impact had started the system pinwheeling, at the rate of about two revolutions a minute, and Bowman realized that he would have to kill this spin before he could attempt any towing.

At close quarters, this whirling umbrella was uncomfortably impressive, and he was not sure how to tackle it. Bowman had done very little work in space itself, and was not skilled in extravehicular operations-for no man could become an expert in all astronautical techniques. In theory, he could carry out any maneuver with his control jets, and even perform such remarkable feats as tying knots with the mechanical fingers of the remote manipulator, or "waldoes." But that was theory, he lacked the practice, and as he slowly drifted up toward the rotating mass of wires and spars he began to realize that he might have bitten off more than he could chew. To make matters worse, he was now desperately tired.

He brought Alice completely to rest about fifty feet from the antenna, braking the pod with a gentle puff from the retros, and considered his next move. If he tried to grab this slowly turning buzz saw, it would donate some of its momentum to him, and he would start to spin with it. True, he could de-spin it with his side jets-but this was exactly the sort of situation in which even a skilled space construction worker could become hopelessly disoriented.

First he thought of lassoing the thing with his safety line, but then he realized that this would only make matters worse-the antenna would simply wind him in until he collided with it. The impact would be negligible, but he might be in grave danger if the pod became entangled in this spinning mass, and he could not extricate himself again.

Time was steadily running out, but he dared not hurry. He had to think calmly and clearly, tired though he was. In principle, the answer to his problem in dynamics was quite straightforward; it was rather like docking at a spinning space station. If he approached along the axis of rotation, and matched the antenna's spin before he made contact with it, the impact would be as gentle and as harmless as a kiss. He could then clutch the main spars of the antenna with his waldoes, and now that it was firmly attached to the pod, could start to kill the spin. When that had been done he could begin his cosmic bulldozer act, cancel the outward velocity of all this priceless wreckage, and head it back toward home.

But this was not a neatly symmetrical structure like a space station, with a clearly defined axis about which it was turning. It was a huge, shallow dish, badly warped at one side, with some heavy equipment dangling from its center-the whole thing tumbling over and over in space. He maneuvered slowly around it, keeping his distance and trying to locate the spin axis.

Before long, he was hopelessly confused. His mind became full of a slowly rotating montage of curved rods and wires and glittering metallic mesh, through which the stars appeared and disappeared, until he could not be sure what was turning and what was stationary. If he ignored the background of the universe and concentrated on the antenna, there would be no problem, but the universe was not easy to ignore.

Even if he had been in good condition, not exhausted and depressed, he might have succumbed sooner or later. No one is wholly immune to space sickness, however experienced he may be, if the circumstances are right. And in this case, the circumstances were perfect.

The attack hit suddenly, without warning. The stars and the antenna blurred, and Bowman had an overwhelming conviction that he was spinning rapidly in space. He gritted his teeth together as that cold, clammy sensation- never forgotten once it had been experienced-swept over his body. With all the strength of will he could muster, he tried to regain control of his rebellious entrails.

The first urgent task was to close his eyes, and shut out the vision of that spinning chaos-shut it out mentally as well as physically. This was a great help; after a few minutes he felt that he had averted an immediate catastrophe. Presently he dared to look at his instrument panel- that, after all, was one fixed thing in his universe, and he tried to concentrate his attention upon it.

Slowly the dials and numbers came back into focus, and presently he began to feel a little better. The queasy sensation in the pit of his stomach ebbed away, but he dared not risk a relapse by looking out of the window. He was still coming back to normal when Athena suddenly reminded him of the inexorable passage of time.

"fifteen minutes to return sequence," she called, from the now far-distant and steadily receding ship.

Only fifteen minutes! It was incredible. Bowman glanced at his watch to confirm the fact, but he did not really doubt that Athena was telling the truth.

He must make the effort now, or not at all. It was inconceivable to have come all this way, and to be frustrated by a brief spasm of bodily weakness. Slowly, he raised his eyes from the instrument board and stared out the window.

Let's see, he told himself firmly. That point just in front of the servo-motor seems to be almost stationary. If I move in and grab it there . . .

He fed a gentle burst to the rear jet, and Alice drifted toward the turning saucer. At the same time, he flexed the pod's mechanical arms, opening and closing the claws so that they would be ready to grip as soon as the opportunity arose.

He made contact; the claws snapped shut. After that, things began to happen rather quickly.

There was a twisting sensation, as the antenna tried to impart its spin to the pod. Then, almost like some willful living creature-a bucking bronco that did not wish to be ridden-it started to flip over, changing its direction of rotation completely.

Bowman knew at once what had happened, but that did not help him in the least. The diabolical thing was like a gyroscope that had started to precess, because torque had been applied to it. It was tumbling in space, and he was tumbling with it.

In a few seconds it would take up a new, stable mode of rotation, turning more slowly now because of his parasitic mass. But in those few seconds, he would be completely incapacitated.

He released the claws; the antenna gave him a final, gentle swipe and Alice broke away, turning over and over with the spin she had acquired in the transaction. Bowman just managed to find the EMERGENCY DESPIN button; then he had to fight his own private battle again.

He felt and heard the brief stabbing of the jets as the pod's gyros and autopilot, unaffected by visceral confusion, straightened things out. After that there was a long silence, broken only by Athena's emotionless voice saying: "Ten minutes to return sequence. Repeat, ten minutes to return sequence." But still he did not open his eyes.

Not until Athena had called: "Five minutes to return sequence. Repeat, five minutes to return sequence" did he risk a look at the external world again. The stars were reassuringly motionless; he glanced very quickly at the antenna-so quickly that he had no time to grasp its current antics. He merely noted, with satisfaction, that it was a good hundred feet away.

He knew when he was beaten, and was too tired even to feel much sense of disappointment. Slowly he turned Alice toward the now invisible star of the ship, and checked and rechecked the direction in which she was aimed, and fed just less than half his remaining fuel to the motor. Then, as soon as he was well on his homeward journey, he ordered Athena: "Wake me up in three hours," and made her repeat back her instructions.

That was all he knew until he saw the ship again, still a hundred miles away. It began to grow minute by minute, from a star to a tiny world; and presently he could see the open airlock.

One loneliness was almost over; another was about to begin.

[In this version, Bowman managed to revive the three remaining sleepers, Kaminski, Hunter and Kimball. Discovery made rendezvous with Jupiter, and went into orbit round the giant planet.]

JOVEDAY

The parking orbit in which the ship now moved was a million-mile-long ellipse, coming to within only fifty thousand miles of Jupiter and then swinging out to the orbit of Callisto. Discovery could retrace it forever, if she pleased, making one complete circuit every seven days until the end of time. Sooner or later she would pass within a few thousand miles of each of the inner moons, and could survey them all in detail. And though she would be unable to land on any of them, she still carried enough fuel to make any orbit changes that would improve opportunities for observation.

That seven-day period was very convenient. The first turn around Jupiter had been on a Sunday morning, by the Earth calendar; they would skim past Jupiter, therefore, every Sunday for the whole of the mission. By Wednesday evening they would be out at their far point, the orbit of Callisto, and then the fall back to Jupiter would begin again. It was not surprising that Sunday was soon informally christened "Joveday."

On the very first Monday, on the outward leg of their first orbit, Discovery passed within thirty thousand miles of the satellite Europa. There would be closer approaches later, but this was a good opportunity for the crew to practice with their battery of instruments. They had to learn to make the most of the precious moments when the worlds they had come so far to study grew from points to disks and then to swiftly passing globes.

A group of telescopic cameras mounted in a kind of gun turret outside the Control Deck produced images which could be inspected on monitors inside the ship; then they were stored in a solid-state memory unit which could hold several million high-quality pictures. After a fly-by had been completed, these could be played back and examined at leisure under the different degrees of magnification.

There were also several spectrometers, operating from the short ultraviolet out into the far infrared. These should give dues to the chemical composition of the worlds that were being examined, but their records could be fully interpreted only by the experts back on Earth.

The infrared scanner, on the other hand, provided information of immediate value, which could be understood at a glance. It reproduced a "heat map" of the body at which it was pointed, and so would reveal at once any sources of thermal energy. Originally developed for military purposes, it could spot a power plant even if it was buried under a thousand feet of ice. Since any conceivable civilization or technology-or indeed any living creature- must produce heat, the infrared scanner was one of the most promising instruments at Discovery's command.

The most spectacular, and controversial, instrument that the ship carried was a laser spectrograph, which had been developed especially for the mission, despite the protests of a large section of the scientific community. One critic had said sarcastically, "Why not drop an atom bomb and photograph the debris?"

The idea behind the instrument was very simple. An extremely powerful laser beam was focused through a system of mirrors, on to a target which might be an

asteroid or satellite a few hundred miles away. In a fraction of a second, the object receiving the laser pulse was heated to incandescence, producing its characteristic spectrum. The optical system that sent out the beam caught the returning flash of light, which was then photographed and analyzed. And so it was possible to find the composition of a cold, dark, and inaccessible body that might be racing past at thousands of miles an hour.

It was immediately pointed out that to be probed by a laser beam, even though the damage was restricted to an area only a few inches across, might be regarded as an unfriendly act. So Bowman had been directed to use the instrument only if he was satisfied, beyond all reasonable doubt, that he was not aiming it at an inhabited body.

He had rather mixed feelings about the device. Although he approved of the expedition's "no weapons" policy, he could easily imagine circumstances when the laser spectrograph's nonscientific applications might be more than useful. It was reassuring to know that they were not completely defenseless.

JUPITER V

Moving more and more slowly as she approached the far point of her ellipse, Discovery soared past the orbits of Ganymede and Callisto-but they were out of range on the other side of Jupiter. The ship began to fall back, cutting again across their orbits, as well as those of Europa and Io. She was about to make her first approach to the closest and in some ways oddest of all the satellites, tiny Jupiter V.

Only seventy thousand miles above the turbulent Jovian cloudscape, and completing each orbit in less than twelve hours, Jupiter V is the nearest thing to a natural synchronous satellite in the whole Solar System. For as Jupiter revolves in about ten hours, V stands almost still in its sky, drifting very slowly indeed from east to west.

It was not easy to observe Jupiter V. The tiny moonlet, only a hundred miles in diameter, was so close to Jupiter that it spent much of its time eclipsed in the planet's enormous cone of shadow. And even when it was in the sunlight, it moved so rapidly that it was hard to find and to keep in the field of view.

The fly-by on the morning of that second Joveday was not very favorable, the satellite was twenty thousand miles away, and visible only for about ten minutes. There was time for nothing more than a quick look through the telescopes, while the cameras snapped a few hundred shots of the rapidly vanishing little world.

The detailed examination of the photos would take several hours; after a while the endless repetition of impact craters, fractured rocks, and occasional patches of frozen gas produced something close to boredom. But no one could tear himself away from the screen; and at last, after more than half the stored images had been scanned, patience was rewarded.

The crucial sequence had been taken with a telephoto lens, just as Jupiter V was emerging from shadow. At one moment there was a black screen; then, magically, a thin crescent suddenly materialized, as the little moon came out of eclipse.

Kimball was the first to spot the curious oval patch near the terminator. He froze the picture, and zoomed in for full magnification. As he did so, there were simultaneous gasps from all his colleagues.

Part of the side facing Jupiter had been sheared off flat, as if by a cosmic bulldozer, leaving a perfectly circular plateau several miles across. At its center was a clear-cut, sharply defined rectangle, about five times as long as it was wide, and pitch-black. At first glance it seemed to be a solid object; then they realized that they were staring into shadow; this was an enormous hole or slot, wide enough to engulf Discovery, and extending deep into the heart of Jupiter V. It was at least a quarter of a mile in length, and perhaps a hundred yards wide.

Time and geology could play some odd tricks with a world; but this was not one of them.

It was an unusually quiet and subdued group that gathered in the artificial gravity of the carousel for the luxury of coffee that could actually be drunk from cups, not squirted from plastic bulbs.

The wonder and the excitement of the discovery had already passed, to be replaced by more somber feelings. What until now had been only a possibility-and, to tell the truth, rather a remote one-had suddenly become an awesome reality. That pyramid on the Moon had been astonishing, but it was only a tiny thing. This was something altogether different-a whole world with a slice carved off, just as one may behead an egg with a knife.

"We're up against a technology," said Bowman soberly, "that makes us look like children building sandcastles on the beach."

"Well," answered Kaminski, "we suspected that from the beginning. Now the big question is-are they still here?"

Jupiter V looked utterly lifeless, but an entire civilization could exist, miles below the surface, at the bottom of that rectangular chasm. The creatures who put TMA-1 on the Moon, three million years ago, could still be going about their mysterious business.

Perhaps they had already observed Discovery, and knew all about this mission. They might be totally uninterested in the primitive spacecraft orbiting at their threshold; or they might be biding their time.

FINAL ORBIT

This was the situation classified in the mission profile as "Evidence of intelligent life-no sign of activity," and the response had been outlined in detail. They would do nothing for ten days except transmit the prime numbers 1 . . . 2 . . . 3 . . . 5 . . . 7 . . . 11 . . . 13 . . . 17, at intervals of two minutes, over a broad band of the radio spectrum. Luckily, the loss of the main antenna complex did not affect this operation; the low-powered equipment on the Control Deck was quite adequate for such short-range work.

They called, and they listened on all possible frequencies; but there was no reply. Though this could indicate many things, it began to seem more and more likely that the tiny moonlet was abandoned. It was hard to believe that it could ever have been anything except a temporary encampment for an expedition-from Jupiter itself, or from the stars?

While they were waiting and watching, and continuing to survey the other four moons whenever the opportunity arose, Bowman prepared for the next step. If it was physically possible, Discovery would make a rendezvous with Jupiter V.

Kaminski spent hours considering approach orbits; Athena spent seconds computing them. The maneuver was a very difficult one, for though Jupiter V's own gravity was negligible, the satellite was trapped deep in Jupiter's enormous gravitational field. Discovery would have to make a speed change of over twenty thousand miles an hour to match orbits and achieve a rendezvous.

It could just be done-and, ironically, only the earlier disasters made it possible. The ship was more than a ton lighter than expected at this stage of the mission, for it had lost two crew members, a spacepod, and the antenna complex. That was enough to make the difference between a maneuver that was barely feasible, and one which had a good safety margin.

Once Discovery had entered the parking orbit around Jupiter V, she could never leave it; her propellant reserves would be completely exhausted. And though the recovery ship would hardly expect to find her here, it would soon spot her radio beacon and her flashing strobe lights. Nuclear batteries would power them for twenty years; their detectable range was only about a million miles, but that was ample.

As soon as he was sure of the calculations, Bowman wasted no more time. The ten days were up: Jupiter V was still silent. The mission profile said: "Proceed with caution-in the event of hostility, withdraw."

That was excellent advice-except that retreat would be impossible. Once they had used their final reserves, they would be wholly committed.

After more than fifty orbits of Jupiter V, they had mapped and inspected its entire surface, most of which was covered with an icy rime of frozen ammonia. There was no sign of life, no hint of any activity. A search for radio emissions or electrical interference was fruitless; the little moon appeared to be completely dead. The theory that it was some kind of abandoned base, perhaps even a deserted city-world that ages ago had come here from some other solar system, slowly gained ground. Hunter was its chief advocate; when asked where he thought the hypothetical star- people had gone, he answered: "I think they were our ancestors." He was more than half serious about this, and refused to budge in the face of all the anthropological and geological evidence that could be thrown at him.

On the fourth day they dropped two of the ship's soft-landing probes-one on Kimball's Plain, the other at its antipodes. The radioed reports were inconclusive: the seismographs could detect no tremors-the sensitive geophones, not a whisper of internal sound. As far as the instruments could tell, Jupiter V was a dead lump of rock.

After two more days of waiting to see if anything had emerged to investigate the probes, Bowman made his decision. The others had been expecting it; from time to time, each had quietly hinted to Bowman that he should be the one to make the first reconnaissance.

In the carousel lounge, which had once seemed so small but was now, alas, larger than they required, he outlined the plan.

"We have only two pods," Bowman began, "and I'm going to commit them both: I think it will be safer that way. If one gets in trouble, the other will be there to help.

"Two pods will go down to the surface; one will stay on the brink of the chasm and the other will go in for a distance of not more than a thousand meters-less, if there's the slightest sign of danger. I'll take the forward one; Jack will be my Number Two."

At this, there were groans from Kaminski and Hunter; Bowman smiled and shook his head firmly.

"You have to stay behind and run the ship. If we don't come back, there's absolutely nothing you can do to help us. Your job is to watch, record what happens, and see that Earth gets the story-even if it's five years from now."

He listened patiently while Hunter and Kaminski pressed their superior claims, but he had already made up his mind. They were all equally qualified, but Kimball had discovered this place, and it now bore his name. It was only fair that he should be first to set foot on it.

Within an hour, the airlocks opened and the two little pods jetted themselves slowly out into space. After a few seconds of careful braking, they had checked their orbital speed, and Discovery was pulling away from them at her regular two hundred miles an hour. They were falling free, in the weak gravity field of Jupiter V. Their tenthousand-foot drop here was equivalent to a fall of less than a hundred feet on earth; they could wait until they were quite close to the surface before attempting to brake.

After a one-minute hover at a thousand feet, Bowman gave the signal for the final descent. There were no landing problems on this utterly flat plain, and he had decided to come down within a hundred yards of the pit. A last burst of power canceled the space pod's five or six pounds of weight, and he hovered for a second to give Kimball the privilege of landing first. Then he touched down on Jupiter V with scarcely a bump.

He glanced out of the port, saw that Kimball was O.K., and called the ship.

"Bowman to Discovery. Landed on Jupiter V. Can you read me?"

The answer, as he had expected, was already fading. In the few minutes of their descent, the ship's orbit had taken it down to the horizon, and was dropping below the edge of the satellite.

"Discovery to Bowman. Message received but signal strength fading. Good luck. Will listen out and call you in ninety minutes."

"Roger."

Discovery was gone-not yet twenty miles away, but out of reach. It was true that she would be back again, by the inexorable laws of celestial mechanics, in just one and a half hours as she came up over the opposite horizon of this tiny world. That knowledge was some help, but not as much as they would have liked, to a pair of lonely men faced with a three-million-year-old enigma

Jetting the pod twenty feet off the surface, Bowman aimed toward the opening of the pit. As he approached that dark, gaping cavity, he suddenly remembered a

childhood impression. When he was about ten years old, his father had taken him to the Grand Canyon, and the shock of first seeing that stupendous wound on the face of the earth had left a permanent imprint on his mind. The rectangular cleft toward which he was now drifting was tiny by comparison-but in this setting, on this desolate world, with the ominous half-moon of Jupiter hanging forever fixed in the inky sky-it seemed as awe-inspiring as the Grand Canyon. More so, indeed, for it was far deeper, and he could not guess what it concealed.

He brought the pod to rest a few feet from the brink, and surveyed the smooth, polished walls converging into the depth. The far walls were brilliant in the light of the sun, which ended abruptly in a slashing line of shadow about four hundred feet down. The feebler light of Jupiter, shining straight into the cleft, seemed to lose its power at a distance which Bowman could not even guess. Their was no sign of a bottom; the pit was like a classical exercise in perspective, all its parallel lines meeting at infinity. He tied the small, portable light which hooked onto the side of his space pod to his safety line, and let it fall the full length of the thousand meters. It took three minutes of uncannily slow-motion descent for the line to become taut; then the lamp was a bright star far down against the face of the shadowed wall. It had encountered no obstacles, provoked no reaction. Jupiter V had maintained its usual indifference.

Bowman suddenly decided that he had been cautious long enough. Not only were they running out of time, but there was only limited fuel for the pods. They had to make every minute count.

"I'm going in," he told Kimball. "I won't go further than the end of your safety line. Haul me out when I give the signal-or if I don't answer when you call me."

He could have made a free fall and come back on the jets, but there was no need to waste precious fuel. Kimball could reel him back without difficulty, for the safety line would have an apparent weight of only about five pounds at its end.

"Keep talking all the way, skipper," said Kimball. "It's kinda lonely up here."

Bowman was perfectly willing to comply. No matter how accustomed one became to low gravity, the ingrained responses of a million terrestrial ancestors died hard. He had to keep reminding himself that this pit in which he was dangling was not a miles-deep shaft on earth, down which he could go crashing to destruction if the slim thread of the safety line snapped. Though there might be danger here, it was not from gravity, and he must ignore the insistent warnings of his instincts.

"I must be two hundred feet down now," he said to Kimball. "Keep lowering me at the same rate-there's nothing to see yet, but I'll get a better view as soon as I'm out of the sunlight. Radiation count still negligible. There goes the sun-now I'm in the shadow, but there's still plenty of light from Jupiter. Still no sign of a bottom- this thing must be at least five miles deep-I feel like an ant crawling down a chimney-HELLO . . . !"

His voice trailed off in sudden excitement.

"What is it? Do you see something?" Kimball demanded.

"Yes-I think so. Now I'm out of the glare, my eyes are getting more sensitive. There's a light down there- a very dim one-a hell of a long way off. Just a minute while I unship the telescope."

There were sounds of heavy breathing and metallic clankings from Bowman's pod, now almost half a mile below the surface of Jupiter V. From the lip of the shaft where his own tiny private spacecraft was balanced as far over the brink as he dared risk it, Kimball could see the other pod only as a little group of red and white identification lights. He waited, with mounting excitement and impatience, as Bowman took his time with the telescope.

Then, coming from far below via the speaker of the radio link, came three simple words that chilled him to the bone.

"Oh my God . . ." said David Bowman, very quietly in a tone that conveyed no fear or alarm-only utter, incredulous, surprise.

"What is it?!"

He heard Bowman draw a deep breath, then answer in a voice that he would not have recognized, yet was completely under control.

"You won't believe this, Jack. That light down there-I wasn't mistaken. I've got the telescope on it-the image is perfectly dear. I can see the bottom end of the shaft. And it's full of stars."

THE IMPOSSIBLE STARS

"Say it again, Dave," said Kimball. "I didn't hear you clearly."

"I said it's full of stars."

"Do I read you correctly-stars?"

"Yes-thousands of them. It's like looking at the Milky Way."

"Listen, Dave-I'm going to haul you up and have a look myself-okay?"

To Kimball's surprise, Bowman agreed at once to this change of plan. Usually it was very difficult to divert the skipper from any procedure he had decided upon: he was fond of quoting Napoleon's "Order plus counterorder equals disorder." But now, he seemed not only willing but anxious to change places.

The line came up effortlessly; Bowman was obviously using the jets to help. When the pod floated up over the edge of the slot, Kimball peered into the bay-window, and was relieved to see his friend smile back, though in a slightly dazed manner.

"Sure you're okay?" he asked.

Bowman nodded.

"Sure," he said. "Go down and look yourself."

As the flawlessly smooth walls drifted by him, unbroken by any markings, unscarred by age, Kimball could not help recalling Alice's fall down the rabbit

hole. It was an uncomfortable memory, for that strange descent had led to an underworld where magic reigned, and the normal laws of nature were overthrown. For the first time, he began to wonder if this might be happening here.

From the very beginning, they had known that they were dealing with a science greater than man's. But they had not doubted-they dared not doubt-that it was a science that they could ultimately understand. As the light below grew in size and brilliance, Kimball felt the first, appalling intimations that this might not be true.

It was a thought to hold at arm's length, especially in surroundings such as these. He was coming to the end of the line, and was already far below the last reflected rays of the sun. It required an act of physical courage to put the binoculars to his eyes, and to stare steadfastly at the tunnel's glowing end.

Bowman was right. He could have been looking at the Milky Way. The field of the instrument was full of stars- thousands of them, shining in the black core of this tiny, frozen world.

Some facts are so incredible that they are believed at once, for no one could possibly have imagined them. Kimball never doubted the message of his eyes, and did not try to understand it. For the moment, he would merely record what he saw.

Almost at once, he noticed that the stars were moving. They were drifting out of the field on the left, while new ones appeared from the right. It was as if he was looking down a shaft drilled clear through Jupiter V, and observing the effects of its rotation as it turned on its axis every ten hours.

But this, of course, was impossible. They had mapped and surveyed the entire area of the satellite, deliberately searching for any other entrance, and had found nothing but unbroken rock and ammonia ice. Kimball was quite certain that there was no window at the antipodes through which stars could shine.

And then, rather belatedly-he was, after all, a communications engineer and not an astronomer-he noticed something that totally demolished this theory. Those stars were drifting to his left; if the movement had been due to Jupiter V's spin, it should have been in a direction almost at right angles. So the rotation of the little moon had nothing whatsoever to do with it....

That was quite enough for one man, on one visit.

"I'm coming up," he called Bowman. "We'd better talk this over with Vic-maybe he has an explanation."

When he had rejoined Bowman on the surface of the satellite, it seemed to him that the once incredible sight of Jupiter spanning the sky was as familiar and reassuring as a quiet country landscape back on Earth. Jupiter they understood-or where it still held mysteries, they were not such that sapped the mind. But the thing beneath their feet defied all reason and all logic.

They waited, lost in their own thoughts and saying nothing, merely listening for the first sound of Discovery's beacon as she came up over the horizon. Luckily for their peace of mind, she was exactly on time; still without a word, they jetted themselves up toward her and, ten minutes later, were jockeying themselves through the airlock.

Astronauts are somewhat addicted to harmless practical jokes; it is one of their ways of asserting superiority over the Universe, which has no sense of humor. Kaminski and Hunter might, for a moment, have thought that the others were pulling their legs, but their doubts lasted no more than seconds.

Two orbits later, they went down themselves, taking cameras with long-focus lenses to record the star-patterns at the bottom of the shaft. Within minutes, Kaminski had an additional piece of information. He timed the movement of the stars across the opening, and calculated that it took fifteen hours for a complete revolution-as against Jupiter V's ten. It seemed that, by some magic of space or time, they were looking out into a strange universe through a window in the surface of a world that turned upon its axis once in every fifteen hours.

Kaminski was almost half a mile down the shaft when with shocking abruptness, the window looked upon a different scene.

SOMETHING IS SERIOUSLY WRONG WITH SPACE

Hunter, up on the surface, heard and recorded every word.

"I'll try a long exposure with the thousand-millimeter lens," Kaminski began. "I hate to confess it, but this is the first time I've ever done any astronomical photography. ... Hello!"

"What's happening?"

"The end of the slot's getting lighter. Yes, there's no doubt of it. There's a very faint glow along one side. You know, it looks like-my God-that's what it is!!"

"What, for heaven's sake?!"

"Sunrise! Sunrise! Leave me alone-I want to watch."

There were maddening minutes of silence, during which Hunter could hear only Kaminski's heavy breathing and, occasionally, the sound of instruments and controls being operated. Then, at long last, the astronomer spoke again, his voice full of wonder.

"It's a sun, all right. And it's enormous-it's completely filling the view. If I could see it all at once, it would look as big as Jupiter.

"And it's not a G-zero type like our sun. It's very dull and red-I don't even need dark filters on the telescope. Must be a red giant, like Antares. That's an idea-maybe it is Antares. Ah, here comes a sunspot-looks pretty small, but it could be as big as our whole sun...."

His voice trailed off into silence and again Hunter possessed himself in patience until at last Kaminski said: "Still no change-that sun's still blocking the view. It'll take hours to move out of the way. Let's get back to the ship-I want to study these photos. And I'd like to try an experiment, if I can talk Dave into it."

"What sort of experiment?"

"We still have most of our instrumented probes. This is the place to use them."

When they returned to the ship, Bowman was at first reluctant. If anything was dropped down the shaft, he pointed out, even this low gravity could give it a terminal speed of over a hundred miles an hour. There was no telling what damage it might do-or what reactions it might produce.

Kaminski finally settled the argument by pointing out that the designers of this place would certainly have protected their handiwork against such trivial accidents. Every few centuries, a large meteor must plunge into the chasm at a far higher speed than any falling probe could attain.

Once the project had been agreed upon, Kimball acted as bombardier. Since the orbiting Discovery could track the probe only during the few seconds while it was passing directly over the slot, space capsule Alice was fitted with receiving gear. Kimball dropped the probe at the exact center of the chasm, then flew to the edge and waited on the brink, Alice's receiving antenna jutting out over the abyss.

At first the probe fell with the lethargic slowness to be expected in Jupiter V's gravity field. Its instruments recorded a very slight temperature rise, but nothing else of importance. There was no radioactivity, no magnetic field.

And then, five miles down, it began to accelerate. Its signals started to drop rapidly in pitch, indicating a Doppler effect of astonishing magnitude. Kimball had to continually retune the receiver in order to keep track of the signals, and the radar started to indicate impossible ranges and velocities. In a few seconds, the probe was two hundred miles away-which, taken at face value, meant that it had gone right through Jupiter V and out the other side. Thereafter, it became more and more difficult to detect, and swiftly passed beyond the tuning range of the receiver. On the last contact, it had descended nine thousand and fifty miles down a hole which under no circumstances could be more than a hundred miles deep-the diameter of the tiny moon.

The radar was working perfectly; Kimball checked it with the utmost care as soon as he got back to the ship. The trouble must lie in Jupiter V-and Hunter neatly summed up what everybody was now beginning to suspect.

"I'm afraid," he said, "that there's something seriously wrong with space."

"A long time ago," said Kaminski, "I came across a remark that I've never forgotten-though I can't remember who made it. 'Any sufficiently advanced technology is indistinguishable from magic.' that's what we're up against here. Our lasers and mesotrons and nuclear reactors and neutrino telescopes would have seemed pure magic to the best scientists of the nineteenth century. But they could have understood how they worked-more or less- if we were around to explain the theory to them."

"I'd be glad to settle without the theory," remarked Kimball, "if I could even understand what this thing is-or what it's supposed to do."

"It seems to me," said Bowman, "that there are two possibilities-both just about equally impossible. The first is that Jupiter V is hollow-and there's some kind of micro-universe down there. A whole galaxy a hundred miles across."

"But the probes went thousands of miles, according to the radar readings."

"There could be some kind of distortion. Suppose the probes got smaller and smaller as they went in. Then they might seem to be thousands of miles away, when they were still really quite close."

"And that," said Kaminski, "reminds me of another quotation-one of Niels Bohr's. 'Your theory is crazy- but not crazy enough to be true.' "

"You have a crazier one?" asked Hunter.

"Yes, I do. I think the stars-and that sun down there- are part of our own universe, but we're seeing them through some new direction of space."

"I suppose you mean the fourth dimension."

"I doubt if it's anything as simple as that. But it probably does involve higher dimensions of some kind. Perhaps non-Euclidean ones."

"I get the idea. If you went down that hole, you'd come out hundreds or thousands of light- years away. But how long would the journey really be?"

"How long is the journey from New York to Washington? Two hundred miles if you fly south. But twenty-four thousand if you go in the other direction, over the North Pole. Both directions are equally real."

"I seem to remember," said Bowman, "that back on Earth you once told me that shortcuts through space-time were scientific nonsense-pure fantasy."

"Did I?" replied Kaminski, unabashed. "Well, I've changed my mind. Though I reserve the right to change it back again, if a better theory comes along."

"I'm a simpleminded engineer," said Hunter rather aggressively. "I see a hole going into Jupiter V, and not coming out anywhere. But you tell me that it does come out. How?'

Everyone waited hopefully for Kaminski to answer. For a moment he hemmed and hawed, then he suddenly brightened.

"I can only explain by means of analogy. Suppose you were a Flatlander, an inhabitant of a two- dimensional world like a sheet of paper-unable to move above or below it. If I drew a circle in your flat world, but left a small gap in it, you would say that the gap was the only way into the circle. Right?"

"Right."

"If anyone went into the circle, they could only come out the same way?"

"So that's what you're driving at. The circle could be a cross-section of a tube passing through Flatland. If I was clever enough to crawl up the tube, by moving into the third dimension, I would leave my flat universe altogether."

"exactly. But the tube might bend back into Flatland again, and you could come out somewhere else. To your friends, it would seem that you'd traveled from A to B without crossing the space between. You'd have disappeared down one hole and emerged from a totally different one, maybe thousands of miles away."

"But what advantage would that be? Surely the straight line in Flatland itself would still be the shortest distance between A and B."

"Not necessarily. It depends what you mean by a straight line. Flatland might really be wrinkled, though the Flatlanders wouldn't be able to detect it. I'm not a topologist, but I can see how there might be lines that were straighter than straight, if some of them went through other dimensions."

"We can argue this until kingdom come," said Hunter. "But supposing it's true-what shall we do about it?"

"There's not much we can do. Even if we had an unlimited fuel and oxygen supply, it might be suicide to go into that thing. Though it may be a shortcut, it could be a damn long one. Suppose it comes out somewhere a thousand light-years away-that won't help us, if the trip takes a century. We wouldn't appreciate saving nine hundred years."

That was perfectly true; and there might be other dangers, as inconceivable to the mind of man as this anomaly in space itself. Discovery had come to the end of her travels; she must remain here in an eternal orbit, just a few miles from a mystery that she could never approach.

Like Moses looking into the promised land, they must stare at marvels beyond their reach.

BALL GAME

After a while they began to call it the Star Gate; no one was quite sure who coined the name. And because the human mind can accept anything, however strange, its mystery soon ceased to haunt them. One day, perhaps, they would understand how the stars were shining down there at the bottom of that chasm; the night sky, reflected in a pool of still water, might have seemed just as great a mystery to early man.

They still had twenty days of operating time before they would have to go into hibernation, and there was enough fuel for the pods to make five more trips down to the surface. Bowman allowed three visits, at internals of a week, and then left the pods in their airlocks, fully provisioned, ready for any future emergency that might arise.

The descents taught them little more than they already knew. They watched the regular transit of those strange stars and the giant red sun, drifting with clockwork precision across the distant end of the Star Gate-still in a direction, and at a speed, that had nothing to do with the spin of Jupiter V itself.

Kaminski brooded for hours over his photographs, trying to identify the star patterns with the aid of the maps stored in Athena's memory. His total failure neither disappointed nor surprised him. If indeed he was looking out through a window onto some remote part of the Galaxy, there was no hope of recognizing the view. One of those faint stars might even be the Sun; he could never identify it. From a few score light-years away, Type G-zeroes are as indistinguishable as peas in a pod.

The three remaining instrumented probes were dropped at intervals of a week-the last one, just before hibernation was due to commence. Each performed in an identical manner, dwindling away into impossible distances before its signals were lost. The record depth-in this hundred mile-diameter world!-was eleven thousand miles....

After that, they had done everything that was humanly possible, their stores were almost exhausted, and it was time to sleep. In one sense, their mission had been a success, they had discovered what they had been sent to find-even if they did not know what it was. But in another, the expedition had failed, since they could not report their findings to Earth. All Kimball's attempts to re-establish communications with jury-rigged antennas and overloaded output circuits had been successful. The daily messages and news reports continued to come in, and were at once encouraging and frustrating. It was good for their morale to know that Earth, and their friends, had not forgotten them, and that the preparations for their return were going ahead at the highest priority. But it was maddening not to be able to reply, and to be the custodians of a secret that would rock human society to its foundations.

And it was also unsettling to hear the messages that continued to arrive for Poole and Whitehead, and to see the faces of their friends and relatives as they sent greetings to men who had been dead for months. It was a constant reminder of their own uncertain future, now that it was time for their hibernation to begin.

There were better places to have slept, but they had little choice in the matter. They could only hope that Jupiter V would continue to treat them with complete indifference, as they circled it every ninety minutes until, three or four or five years from now, the recovery expedition arrived.

During the last days they checked every detail of the ship, closed down all unnecessary equipment, and tried to anticipate everything that could possibly go wrong. The shadow of Poole's death often lay heavy on their minds, but they never mentioned it. Whether it had been due to a random failure, or a loss of tolerance, there was nothing that could be done. They had no alternative but to proceed as planned.

One by one, their work completed, they made their goodbyes and went to rest, until at last only the captain was left. To Bowman, all this had a haunting familiarity; once before he had cracked the same jokes, made the same-he hoped-temporary farewells, and had been left alone in the sleeping ship.

He would wait two days before he followed the others. One would be long enough to check that everything was running smoothly; the second would be his own-to share with the last game of the World Series.

Curiously enough, while on Earth, he had never been an avid baseball fan, but like all the members of the crew he had acquired a passionate interest in the sport programs relaying from Earth. One day more or less made no difference to Bowman now, and he was anxious to see if the New York Yankees would make a comeback after their long years in the doldrums. He doubted it; the Mets seemed more impregnable than ever.

And so, in the now deserted Control Center, David Bowman took his leave of the strangest sky that any man had ever seen. Half of it was filled with the steeply curving, ammonia-spattered landscape of Jupiter V; most of the rest was occupied by Jupiter itself. A huge, waning crescent, it was shrinking almost visibly as the ship rushed into its shadow; the distant Sun would soon be eclipsed behind it. And when, thought Bowman, shall I see the sun again?

The solar glare had already swallowed up the evening star called Earth. But though he could not see the world of men, its voice was still echoing through

the ship, and on the Control Center monitor screen was a spectacle that would doubtless have baffled many quite intelligent extraterrestrial races.

One entity, holding a stubby rod in both hands, confronted another carrying a small spherical object. They both stood on a flat, triangular area of ground, while grouped around them in frozen, expectant postures, were some dozen other individuals. And at a greater distance, thousands more sat motionless on concentric tiers of seats.

The creature holding the sphere started to whirl its grasping limb around with ever-increasing violence. Suddenly, so swiftly that the eye could hardly follow its motion, the sphere escaped from its resting place and hurtled toward the entity with the rod. The creature was obviously in grave danger-but the projectile missed the intended target, and went racing past it.

There was a brief flurry of activity; then the sphere was returned to the original holder. The ordeal, it seemed, was to continue....

This time, however, the victim was able to defend himself more effectively. Puny though his protective shield was by luck or skill he managed to intercept the hurtling projectile-and even to send it soaring back over the head of his tormentor. Then, while his enemies were distracted, he started to spring for safety....

But Bowman never saw Malczinsky finish his home run. At that moment the alert and sleepless Athena, still watching over the ship, sounded the collision alarm.

The image from Earth was wiped off screen, as if it had never existed, to be replaced by the impersonal rings and spokes of the radar display. Bowman read their message in a second-and felt a sense of freezing loneliness that he had not known even when he had sent Kelvin Poole to follow Peter Whitehead to the stars.

Once more he was the only master of the ship, with none to help or advise him, in a moment of crisis. And this was a crisis indeed, for twenty miles ahead, directly in his line of flight, something was rising out of the Star Gate.

LAST MESSAGE

A moment later, Bowman switched to the high-definition display, and had a second surprise. The object was quite small-only about six feet long. Far too large to be a meteor, yet far too small to be a spaceship. He did not know whether to be disappointed, or relieved.

He locked the optical telescope onto the radar, and peered eagerly through the eyepiece. There it was, glinting in the sunlight-obviously metallic, obviously artificial. And then he cried out in astonishment; for the thing soaring out of the abyss was one of Discovery's own space probes, dropped into Jupiter V days or weeks ago.

He switched on the radio and searched the telemetry band. The signal came in at once, loud and clear. All these probes had short-lived power supplies, so that they should not clutter up the spectrum when they had done their -work-but this one was still radiating. A quick check of the frequency confirmed what he had already guessed.

This was the very last probe they had dropped into the Star Gate. It had vanished into that abyss, eleven thousand miles "down," while apparently moving faster than any manmade object in history. Yet now it had returned, still in perfect working order-only two days later.

It was moving quite slowly, rising up towards the face of Jupiter. And presently it vanished from sight against that looming disk; but he could still hear it, chirping briskly as it settled into an orbit that might or might not be stable -but which, he was quite certain, could only be the result of intelligent planning.

This could never have happened by chance, or by the operation of natural laws. The Star Gate had returned their gift; it must have done so deliberately.

Someone or something knew that they were here.

"This is David Bowman, recording for log. The ship is in perfect order and I am now scheduled to join Kaminski and Hunter and Kimball in hibernation.

"I am not going to do so. Instead, I am taking one of the pods, which is fully provisioned and fueled, and am descending into the Star Gate.

"I am completely aware of the risks, but I consider them acceptable. The safe return of our probe, after only two days, is proof that an object can pass unharmed through the Star Gate in a short period of time. I have enough oxygen for at least the one-way trip, and am prepared to take my chances at the other end.

"It seems to me that this is an invitation-even a sign of friendliness. I'm prepared to accept it as such. If I am wrong-well, I won't be the first explorer to make such a mistake.

"Bill, Vic, and Jack-if I don't see you again, good luck, and I hope you make it back to Earth. This is Dave, signing off."

THE WORLDS OF THE STAR GATE

A water who sets out to describe a civilization superior to his own is obviously attempting the impossible. A glance at the science fiction of fifty-or even twenty-years ago shows how futile it is to peer even a little way into the mists of time, and when dealing merely with the world of men.

Longer-range anticipations are clearly even less likely to be successful; imagine what sort of forecast one of the Pilgrim Fathers could have made of the United States in the year 1970! Practically nothing in his picture would have had any resemblance to the reality-which, in fact, would have been virtually incomprehensible to him.

But Stanley Kubrick and I were attempting, at the climax of our Odyssey, something even more outrageous. We had to describe and to show on the screen-the activities and environments, and perhaps the physical nature, of creatures millions of years ahead of man. This was, by definition, impossible. One might as well expect Moon-Watcher to give a lucid description of David Bowman and his society.

Obviously, the problem had to be approached indirectly. Even if we showed any extraterrestrial creatures and their habitats, they would have to be fairly near

us on the evolutionary scale-say, not more than a couple of centuries ahead. They could hardly be the three-million-year old entities who were the powers behind the Black Monolith and the Star Gate.

But we certainly had to show something, though there were moments of despair when I feared we had painted ourselves into a corner from which there was no possible escape-except perhaps a "Lady or the Tiger" ending where we said goodbye to our hero just as he entered the Star Gate. That would have been the lazy way out, and would have started people queuing at the box office to get their money back. (As Jerry Agel has recorded, at least one person did just this-a Mrs. Patricia Attard of Denver, Colorado. If the manager of the handsome Cooper Cinerama did oblige, I shall be happy to reimburse him.)

Our ultimate solution now seems to me the only possible one, but before arriving at it we spent months imagining strange worlds and cities and creatures, in the hope of finding something that would produce the right shock of recognition. All this material was abandoned, but I would not say that any of it was unnecessary. It contained the alternatives that had to be eliminated, and therefore first had to be created.

Some of these Lost Worlds of the Star Gate are in the pages that follow. In working on them, I was greatly helped by two simple precepts. The first is due to Miss Mary Poppins: "I never explain anything."

The other is Clarke's Third* Law: "Any sufficiently advanced technology is indistinguishable from magic."

*Oh, very well. The First: "When a distinguished but elderly scientist says that something is possible, he is almost certainly right. When he says it is impossible, he is very probably wrong." (Profiles of the Future)

The Second: '`The only way of finding the limits of the possible is by going beyond them into the impossible."

I decided that if three laws were good enough for Newton, they were good enough for me.

Stanley once claimed if anything could be written, he could film it. I am prepared to believe him-if he was given unlimited time and budget. However, as we were eventually a year and four million dollars over estimate, it was just as well that the problem of creating explicit super- civilizations was by-passed. There are things that are better left to the imagination-which is why so many 'horror' movies collapse when some pathetic papier-mache monster is finally revealed.

Stanley avoided this danger by creating the famous "psychedelic" sequence-or, as MGM eventually called it, "the ultimate trip." I am assured, by experts, that this is ' best appreciated under the influence of various chemicals, but do not intend to check this personally. It was certainly not conceived that way, at least as far as Stanley and I were concerned, though I would not presume to speak for all the members of the art and special-effects departments.

I raise this subject because some interested parties have tried to claim 2001 for their own. Once, at a science fiction convention, an unknown admirer thrust a packet into my hand; on opening it turned out to contain some powder and an anonymous note of thanks, assuring me that this was the "best stuff." (I promptly flushed it down the toilet.) Now, I do not know enough about drugs to

have very strong views on the matter, and am only mildly in favour of the death penalty even for tobacco peddling, but it seems to me that "consciousness-expanding" chemicals do exactly the opposite. What they really expand are uncriticalness ("Crazy, man!") and general euphoria, which may be fine for personal relationships but is the death of real art .. . except possibly in restricted areas of music and poetry.

This recalls to mind Coleridge's "Kubla Khan," written under the influence of opium and interrupted by the persistent and thrice-accursed "Person from Porlock"-which incidentally, is a charming little village just four miles from my birthplace. At one time I started composing a parody of "Kubla Khan," which started promisingly enough:

For MGM did Kubrick, Stan A stately astrodome decree Where Art, the s.f. writer, ran Through plots incredible to man In search of solvency.... So twice five miles of Elstree ground With sets and props were girdled round . . .

Unfortunately, or perhaps not, inspiration evaporated at this point, and I was never able to work in:

A savage place! as eerie and enchanted As ere beneath a flickering arc was haunted By child-star wailing for her demon mother . . .

still less get as far as the projected ending:

For months meandering with a mazy motion Through stacks of scripts the desperate writer ran Then reached that plot incredible to man And sank, enSCUBA'd in the Indian Ocean. And midst the tumult Kubrick heard from far Accountants' voices, prophesying war!

The three "Worlds of the Star Gate" that follow are, to some extent, mutually incompatible with each other and with the final novel and movie versions. (There were still others-now forgotten or absorbed.) In the first, not only the surviving astronauts but Discovery itself encountered the immortal alien who had walked on earth, three million years ago.

The flying island that is the background of that meeting owes a little to Swift, more to Rene Magritte, and most of all to the Singhalese king Kassapa I (circa 473-491 A.D.) In the very heart of Ceylon, on an overhanging rock five hundred feet above the surrounding plain, Kassapa built a palace which is one of the archeological (and artistic) wonders of the world. When you walk among the windy ruins of Sigiriya, it is easy to believe that you are actually airborne, high above the miles of jungle spread out on every side. Sigiriya is, indeed, uncannily like a Ceylonese Xanadu-complete with pleasure gardens and dusky damsels.

REUNION

Of the Clindar who had walked on Earth, in another dawn, three million years ago, not a single atom now remained; yet though the body had been worn away and rebuilt times beyond number, it was no more than a temporary garment for the questing intelligence that it housed. It had been remodeled into many strange forms, for unusual missions, but always it had reverted to the basic humanoid design.

As for the memories and emotions of those three million years, spent on more than a thousand worlds, not even the most efficient storage system could hold

them all in one brain. But they were available at a moment's notice, filed away in the immense memory vault that ringed the planet. Whenever he wished, Clindar could relive any portion of his past, in total recall. He could look again upon a flower or an insect that had fleetingly caught his eye ten thousand years before, hear the voice of creatures that had been extinct for ages, smell the winds of worlds that had long since perished in the funeral pyres of their own suns. Nothing was lost to him-if he. wished to recall it.

So when the signal had come in, and while the golden ship was being prepared for its journey, he had gone to the Palace of the Past and let his ancient memories flow back into his brain. Now it seemed that only yesterday- not three million years ago-he had hunted with the ape-men and shown Moon-Watcher how to find the stones that could be used as knives and clubs.

"They are awake," said a quiet voice in the depths of his brain. "They are moving around inside their ship."

That was good; at least they were alive. The robot's first report had indicated a ship of the dead, and it had been some time before the truth was realized. They were going to have a surprise, thought Clindar, when they woke so far from home, and he hoped they would appreciate it. There were few things that an immortal welcomed and valued more greatly than surprise; when there was none left in the universe, it would be time to die.

He walked slowly across the varying landscape of his little world, savoring this moment-for each of these encounters was unique, and each contributed something new to the pattern and the purpose of his life. Though he was alone upon this floating rock, unknown myriads of others were looking through his eyes and sharing his sensations, and myriads more would do so in the ages yet to come. Most of them would approximately share his shape, for this was a meeting that chiefly concerned those intelligences that could be called humanoid. But there would be not a few much stranger creatures watching, and many of them were his friends. To all these multiformed spectators he flashed a wry greeting-an infinitely complex and subtle variation on the universal jest that could be crudely expressed in the words, "I know all humanoids look the same-but I shall be the one on the right."

This sky-rock was not Clindar's only home, but it was the one he loved the best, for it was full of memories that needed no revival in the Palace of the Past. He had shared it thirty thousand years ago with a mating group long since dispersed through the Galaxy, and the radiance of those days still lingered, like the soft caress of the eternal dawn.

And because it was far from the shattering impact of the great centers of civilization, it was a perfect place to greet and reassure startled or nervous visitors. They were awed, but not overwhelmed; puzzled, but not alarmed. Seeing only Clindar, they were unaware of the forces and potentialities focused within him. they would know of these things when the time was ripe, or not at all.

The upper surface of the great rock was divided into three levels, with the villa at the highest end, and the flat apron of the landing stage at the lowest. Between them, and occupying more than half the total area, were the lawns and pools and courtyards and groves of trees among which Clindar had scattered the souvenirs of a thousand worlds and a hundred civilizations. The labor force to maintain all this skyborne beauty in immaculate condition was nowhere in sight; the simple animals and the more complex machines that supervised them had been ordered to remain in concealment until the meeting was over. The Eater of Grass

and the Trimmer of Trees, utterly harmless though they were, could cause great terror to other beings who met them without adequate preparation. The only animals now visible on the surface of the rock were two brightly colored creatures, for all the world like flying carpets, that flapped around and around Clindar emitting a faint, musical hum. Presently he waved them away, and they undulated out of sight into the trees.

Clindar never hurried, except when it was absolutely essential, for haste was a sign of immaturity-and mortality. He paused for a long time beside the pool at the heart of his world, staring into the liquid mirror which reflected the sky above, and echoed the ocean far below. He was rather proud of that little lake, for it was the result of an experiment that had taken several thousand years to complete. Six varieties of fish from six different planets shared it, and looked at each other hungrily, but had learned from bitter experience that their biochemistries were highly incompatible.

He was still staring into the pool when he saw the reflection of the golden ship pass across it, as it settled down toward the landing stage at the far end of the rock. Raising his eyes, he watched while the ship came to rest in midair, dematerialized its center section, and extruded the cargo it had carried across the light-years.

The shining artifact of metal and plastic descending at the barely visible focus of the traction field seemed no cruder than most first-generation spacecraft. It touched the surface of the rock, the field supporting it flickered off, and the golden ship departed-to be ready again in a hundred years, or a thousand, as the case might be.

The first ship from Earth had arrived. Why, he wondered, had they taken so long?

Clindar stood in full view at the top of the wide stairway leading down to the landing place. It was hard, he thought, to imagine a greater contrast than that between the two ships lying there. The newcomer was huge and clumsy, covered with crude pieces of equipment that seemed to have been bolted on as an afterthought. His own vehicle, resting a hundred feet away, was only a fraction of the size, and its slim, fluted projectile shape was the very embodiment of speed and power. Even in repose, it seemed about to hurl itself into stars.

The visitors could not fail to observe it, and to wonder in vain at the powers that drove it through the sky. To any inquisitive spacefarers, it was at once a challenge- and a bait.

They had seen him. Through the windows of their ship, they were pointing and gesturing; very vividly, Clindar could imagine their surprise. They had come all this way- by now they must realize that they were in another solar system-and would be expecting to meet the fantastic creatures of an alien evolution. Something as apparently human as himself might be the very last thing they would anticipate.

Well, they would have their full of strangeness in due course, if their minds could face it. There was a preview here, in the line of cyclopean heads flanking the stairway. Though no two were alike, all were approximately human, and all were based upon reality. Some had no eyes, some had four; some had mouths or nostrils, some did not; some had wide-band radiation sensors, others were blind except to ordinary light. There had been a time when many had seemed ugly and even repellent to Clindar, but now they were all so perfectly familiar to him

that he sometimes found it hard to recall which had once seemed hideous. After a thousand worlds, nothing alien was inhuman to him.

He began to walk slowly down the steps, past the graven heads of his still and silent friends. The figures framed in the window of the ship were equally motionless, staring towards him. They could not guess how many thousands of times they were outnumbered, and how many eyes were looking through his.

He reached the foot of the stairway, and began to move across the multihued tapestry of the wire- moss that covered the landing stage. With every step, little shock waves of color went rippling out over the sensitive living carpet, mingling and merging in complex interference patterns that slowly faded out into the distance.

Clindar walked through the dancing wave patterns created by his own footsteps, until he was within forty feet of the ship; now its occupants could see him as clearly as he could see them. He stopped, and held out his hands in the gesture which, throughout the universe, proclaimed: "I have no weapons-I come in friendship." Then he waited. He did not think he would have to wait for long- probably a few hours, certainly no more than a few days. They would be excited and inquisitive, and though they would be cautious, they would be intelligent enough to realize that they were completely in his power. If he wished to harm them, the flimsy walls of their vehicle could give no protection whatsoever.

Already-so soon!-one of them had disappeared from the window, heading into the interior of the ship. The others continued to watch, while adjusting controls and speaking into instruments. They had some kind of recording device focused upon him; he could not remember a single race that had omitted to do this.

A door was opening in the side of the ship. Clumsy and awkward in its protective suit, a figure was standing in the entrance, clutching a large, flat package. Doubtless these creatures knew that they could breathe the atmosphere, but they would also be aware of the dangers of contamination. They were proceeding with care, and Clindar approved.

The figure stepped down onto the moss, and was momentarily distracted by the beauty of the shock waves that went flowing out from its feet. Then it looked up at Clindar, and held the package toward him. After a moment's hesitation, it started to walk.

Slowly, cautiously, the hominid was coming toward him, leaving the shelter of its metal cave. Clindar remained motionless, relaxed yet observant, remembering many meetings, on many worlds.

Now only a few feet away, the creature came to rest and slowly stretched out one opened hand. So this, thought Clindar, is how they greet each other; the gesture was a common one among bipeds, and he had met it often before. He stretched out his own hand in return.

Slim, nailless fingers dosed around flexible glove, meeting across the light-years and the ages. Eyes locked together, as if the minds they mirrored would bypass the medium of speech. Then the hominid dropped its gaze, and handed the package to Clindar.

It consisted of dozens of very thin sheets of some light, stiff material, covered with illustrations and drawings. The first was a simple astronomical diagram, obviously of the planetary system from which the creature came. Arrows pointed prominently to the third planet outwards from the sun.

Clindar turned the page. There, beautifully executed in an apparently three-dimensional color technique, were views of a globe as seen from space, and he recognized the continents at once.

He pointed to himself, then to the heart of Africa. Was the visitor startled? It was impossible to judge the reactions of another hominid until one had grown to know him intimately; the expression of even such basic emotions as fear or hostility was almost entirely arbitrary, differing from species to species.

Almost forgetting his visitor for the moment, Clindar stared at that familiar blunt triangle, whose shape had changed so little in a mere three million years. But everything in that triangle-all the beasts and plants that he had once known, and probably the climate and the detailed topography of the land-would have changed almost beyond recognition.

As these creatures were changed from the starveling savages who were their ancestors. Who could have dreamed that the children of Moon-Watcher would have climbed so far? Though he had watched this happen so many times before, it always seemed a miracle.

Some races were incredibly ignorant of their own past Clindar wondered if they had any conception of the journey they had made from cave to spaceship. It was certain that they could not guess at the journey that still lay ahead.

They had made their first stumbling steps toward the stars-but the freedom of space was only a symbol, and not always an accurate one, of a certain level of understanding. There were many peoples who had stood thus upon the threshold of the universe, only to be destroyed by the sight of treasures too great for their self-control, and mysteries too deep for their minds. Some had survived, at the cost of turning their backs upon the stars, and encapsulating themselves behind barriers of ignorance in their own private worlds. Others had been so shattered in spirit that they had lost the will to live, and their planets had reverted to the mindless beasts.

For there were some gifts too heavy to be born, and for many races, those included the gift of truth, and the gift of time. As he turned the leaves of the book which he had been handed, pausing to look at diagrams and photographs crammed with visual information, Clindar wondered If these newcomers were ready to face the infinite promise of either time or truth.

The garnered art and knowledge of a thousand worlds would be showered upon them, if they wished to receive it. Stored in the memory banks of this very planet were the answers to the questions that had haunted them, as well as the cures of all illnesses, the solutions to all problems of materials and power and distribution-problems that Clindar's race had solved so long ago that they now found it hard to believe that they had ever existed.

They could be shown the mastery of their minds and bodies, so that they could achieve the full expression of their powers, not spend heir lives like ineffectual ghosts trapped in a marvelous machine beyond their skill to operate. They could break the domination of pain, so that it became a sentinel and not a

tyrant, sending messages which the rational mind could accept or ignore as it pleased.

Above all, they could choose to die only when they wished; they would be shown the many paths that led beyond the grave, and the price that must be paid for immortality in all its forms. A vista of infinite time would open up before them, with all its terror and promise. Some minds could face this, some could not; here was the dividing line between those who would inherit the universe, and those who were only quick-witted animals. There was no way of telling into which category any race would fall, until it came to its moment of truth-the moment which this race was now, in total ignorance, so swiftly approaching.

Now, for better or worse, they must leave behind the toys and the illusions of their childhood. Because they would look into the minds and survey the histories of a myriad races, they would discover that they were not unique-that they were indeed low on the ladder of cosmic achievement. And if, like many primitive societies, their culture still believed in gods and spirits, they must abandon these fantasies and face the awesome truths. It would not be for centuries yet, but one day they too might look across the fifty thousand light-years to the core of the Galaxy, glimpse the titanic forces flickering there among the most ancient of the stars-and marvel at the mentalities that must control them.

Meanwhile, there was work to be done; and a world was waiting to meet his guests.

The rock began to move, rotating on its axis so that the shining rainbow of the rings marched around its sky. With steadily increasing speed, the aerial island was driving toward the waterfall that spanned the entire horizon, and the twin towers that flanked it dropped below the edge of the world.

Now the sky ahead was a sheet of veined and mottled whiteness, drifting down forever from the stars. In shocking silence, the island crashed into the wall of cloud, and the golden sunlight faded to a rose-tinged dusk.

The darkness deepened into night, but in that night the island now glowed faintly with a pale luminescence from the sensitive moss and the trees. Beyond that glow nothing was visible, except tendrils of mist and vapor flickering past at an unguessable speed. The rock might have been moving through the chaos that existed before Creation, or crossing the ill-marked frontier between life and death.

At last, the mist began to thin; hazy patterns of light were shimmering in the sky ahead. And suddenly, the rock was through the wall of cloud.

Below it still was that endless sea, lit softly by the pearly white radiance pouring down from the crystal rainbows beyond the sky. Scattered across the ocean in countless thousands, from wave level up to the uttermost heights of the stratosphere, were airborne islands of all possible shapes and sizes and designs. Some were brilliantly illuminated, others mere silhouettes against the sky the majority were motionless, but some were moving with swift purpose like liners catching the midnight tide from some great harbor, the buoys and beacons flashing around them. It was as if a whole galaxy had been captured and brought down to earth; and at its upper edges it merged imperceptibly into the glowing dust of the Milky Way.

After three million years in the wilderness, the children of the apes had reached the first encampment of the Star-Born.

[In the version that follows-Chapters 36 to 39- only Bowman survived to pass through the Star Gate. Stanley Kubrick and I were still groping toward the ending which we felt must exist-just as a sculptor, it is said, chips down through the stone toward the figure concealed within.]

ABYSS

Now his eyes were drawn to the planet that began to fill the sky ahead; and for the first time he realized that it was entirely covered with sea. On the sunlit hemisphere turned toward him, there were no continents, nor even any islands. There was only a smooth and featureless expanse of ocean.

It was a most peculiar ocean-straw-yellow m some areas, ruby-red over what Bowman assumed were the great deeps. At the center of the disk, almost immediately beneath him, something metallic glittered in the sunlight.

And now for the first time, the effects of atmosphere became noticeable. A barely visible ovoid appeared to have formed around the capsule, and behind it trailed a flickering wake of radiation. Bowman could not be sure, but for a moment he thought he could hear the shriek of tortured air: one thing was certain-he was still being protected by the forces that had drawn him to the stars. This vehicle was designed only for the vacuum of space, and a wind of a few score miles an hour could tear it to pieces. But there was no wind against the fragile metal shell; the incandescent furies of reentry were held at bay by an invisible shield.

The metallic glitter grew and took shape before his eyes. He could see now that it consisted of a group of incredibly flimsy towers, reaching up out of the ocean and soaring two or three miles into the atmosphere. At their upper levels they supported stacks of dully gleaming circular plates, translucent green spheres, and mazes of equipment as meaningless to him as a radar station would have been to ancient man.

The capsule was falling down the side of the structure, at a distance of about a mile, and now he could see that all around its base, apparently floating on the surface of the sea, was a mass of vegetation forming a great raft of brilliant blue. Some of the plants climbed for several hundred feet up the latticework of the tower, as if struggling to reach the sun from the lightless ocean depths.

This burst of vegetation did not give any impression of neglect or decay; the great towers climbing through it were obviously quite unaffected by the efflorescence at their feet. On this reddish-yellow sea, the deep blue of the growing plants gave a startling vivid touch of color.

Now the capsule was only a few feet above the ocean and Bowman could see that its surface had a curiously indeterminate texture. It was not as sharply defined as a liquid should be; for the first time, he began to realize that it might be some heavy gas.

Immediately under the capsule, it became concave, as if depressed by an invisible shield. The hole in the fluid

Bowman no longer thought of it as water-became deeper, and then closed over him.

Like a fly in amber, he was trapped in a bubble of crystalline transparency; and it was carrying him down into unknown depths.

The view was astonishing, especially to anyone accustomed to underwater exploration where the limit of visibility was never more than two hundred feet- and very seldom even near that. He could see for at least a mile, and was now certain that he was traveling through not a liquid, but a dense gas.

The "seabed" was just visible as a mottled dark blur far below; there were round patches of light glowing on it ranged in regular lines right out to the misty horizon-like the lamps of cities, seen through a slight overcast. About half a mile away he could see the lower levels of those sky- piercing masts; they were entwined with gigantic roots, and there were clouds of small creatures swimming- or flying, or floating-among them. Though he knew that earthly terms were not applicable here, in his mind he had already labeled them as birds rather than fish; but they were too far away for him to see them clearly.

Then, swooping up toward him out of the depths, came something that was neither a fish nor a bird. It was a tubular object like the body of an early jet plane, with a gaping intake at the front and small fins or flukes at the rear. At first, Bowman thought it was a vehicle of some kind, then, when it was only a few yards away, he realized that it was an animal-driving itself through the water by powerful contractions of the flexible duct that ran the whole length of its body. It hovered just outside the window of the now almost motionless capsule; and then Bowman became aware that it had a rider.

For a moment he thought that the thing attached to it, about a third of the way back from the intake, was a large parasite. But then it suddenly took off, abandoning the tube-beast, and swam briskly toward the invisible bubble surrounding the capsule. Bowman had a perfect view of a beautifully streamlined, torpedo-shaped body, very much like one of the remora or suckerfish that attach themselves to sharks. The analogy was almost exact, for he could even see the set of suction pads that gave the creature a grip on its host.

Then he saw the four large, intelligent eyes, protruding from recesses in the side of the body-where, presumably, they retracted when the animal was moving at speed. There was a mind here, and it was contemplating him.

Presently the suckerfish began to move along the outer surface of the protective bubble, obviously examining the space pod. The riderless tube-beast remained hovering in midwater, pulsing gently from time to time. After a few minutes its master rejoined it, and the pair swiftly shot off into the distance. At the same moment the capsule began to sink again; it was hard to believe that this was a coincidence, and Bowman wondered if the suckerfish were the rulers of this semi-submarine world. But he had seen no trace of any limbs-and without organs of manipulation, it was surely impossible to develop a technology.

The seabed was now coming clearly into sight, and below he saw what looked like phosphorescent palm trees- but he quickly realized the utter folly of trying to judge this place in terms of Earth. Though the objects did look very much like palms, they were certainly nothing of the sort. They had thin, tubular stems about twenty feet high, and these ended in clusters of feathery fronds which beat the fluid around them continually, perhaps in search of food. Some of

the creatures must have sensed him as he passed overhead, for they strained upward in a vain effort to reach the capsule.

The plantation of the luminous tube-beasts stretched for miles down a gentle slope, which ended abruptly in an almost vertical cliff. As the capsule passed over the rim of the plateau, and began to descend down the face of the cliff, Bowman saw that it was festooned with a network of creepers. These formed an intricate tangle that writhed continually, like some monstrous, multi-armed starfish; and sometimes it moved aside to reveal deep caves within which glowed unwavering, meaningless patches of luminescence.

Thousands of feet later, the cliff terminated in a level plain, only dimly illuminated by the light trickling down from far above. It was obviously cultivated, for it was divided up into huge squares and rectangles, tinted different shades of red and brown in this submarine twilight.

The first plants that he was able to examine at close quarters looked like tripods growing from the seabed; they had three black stems or roots that merged into a single trunk about ten feet from the ground. This continued upward for another five or six feet, and ended in a large inverted bowl. There were thousands of these tripods, ranging out to the misty horizon.

Bowman flew over them at a low altitude for several miles before he saw that this strange field had equally strange farmers. Tripods that seemed to belong to the same species, but were colored a pale, fleshy white, were creeping very slowly along the stationary ranks. Not until he had passed several of them was Bowman able to see how they moved.

Their root-legs were dug firmly into the ground, they would pull up one, slide it forward a few feet with slow-motion deliberation, then dig it in again before moving another. He judged that their speed was not more than a mile an hour; but for plants-if they were plants-that was very good going....

Every so often a white tripod would lean toward a stationary one, and the two bells would meet in a kind of floral kiss or vegetable copulation. And then, after a pause of a few seconds, an extraordinary thing would happen.

The bell of the fixed plant would snap off its stem, and go swimming away like an animated parasol-while the rest of the creature collapsed on the seabed He saw at least a dozen of the liberated bells go pulsing off into the distance, and noticed that they all swam in exactly the same direction-straight along the ranks of their "parents" until they had disappeared from sight.

And then there were miles of a kind of nondescript orange moss, which had one astonishing property. Like the tube-plants he had met earlier, it sensed his presence-and it reacted with luminosity. For as the capsule raced across this submarine tundra, a phosphorescent, V-shaped wake spread out below it, slowly fading away about a hundred yards astern.

Then, far ahead, he saw a band of milky white, flickering and dancing across the sensitive moss. He guessed that something had disturbed it, and he quickly saw that his guess was right.

A glowing red blanket, which from a distance looked like a sheet of lava, was crawling over the moss. It was only about fifty feet wide, but it was advancing on a front at least a mile broad, and it left a ribbon of bare, brown soil

behind it. For it was not merely crawling but eating its way forward, consuming the moss in its progress.

Yet its victory was a hollow one, for as it flowed forward it too was being eaten, at such a rate that its width remained roughly constant. All along its trailing edge, clinging to it like giant leeches, were transparent slugs as large as a man; the whole network of their internal organs could be seen, pulsing and throbbing as they feasted.

And who or what eats the slugs? Bowman wondered. He did not learn the answer to this question before the subtly disquieting scene had passed behind him.

Now he had come to the edge of the farmlands, as he still mentally called them for want of a better word, and a range of rocky hills was appearing ahead. They seemed to have been carved out of multicolored strata by some natural erosive force which had left great caves and archways, hundreds of feet high. From the darkness of one cave stretched a bundle of black, whiplike tendrils or tentacles, lying motionless on a sandy seabed that had been recently disturbed, as if a broom had swept over it. It was hard not to connect those tendrils with the scrabblings in the sand, but though Bowman kept a careful watch on them as long as they were in sight, they never stirred.

The capsule was moving parallel to these hills when, for the first time, Bowman became aware of an unmistakable sound from the world outside his protective cocoon. It was a distant roar like a hurricane or a waterfall, and it grew louder minute by minute. And presently his eyes, a little tired of reds and browns and blacks, rested thankfully on a thin column of brilliant white light stretching vertically into the somber sky.

It was like an extremely narrow searchlight, and apparently originated from a point high up in the hills Though its color reminded him of the world he knew, he looked at it with some alarm; for it was the first time he had ever seen a light that roared.

COSMOPOLIS

The brilliant hairline of incandescence emerged from a great metal web, supported on three spires of rock several hundred feet high. All around it was a vast cyclonic disturbance, Bowman felt that he was watching a stationary tornado, and from uncomfortably close at hand.

The tapering funnel of the tornado reared up out of sight through the miles of ocean above his head, and he was certain that it extended all the way into space. Some immense power was holding back the millions of tons of fluid around that fiercely radiant beam; but for what purpose, Bowman could only speculate.

The capsule sped on past the eroded hills, and the fury of the submarine tornado died away. He was moving at a great speed across an empty desert that was crisscrossed with faint white lines, meandering in all directions like the tracks of snails. There was no sign of the creatures who had made them.

He could no longer guess at his depth beneath the surface of this strange sea. The last rays of the sun had faded out miles above him, yet there was light all around. Overhead, living comets drifted through the ocean atmosphere, sometimes flashing on and off like electric signs; and once a great swarm of shining spirals, of all sizes and traveling in exactly parallel lines, went spinning past.

But now the light ahead was growing minute by minute; and presently he could see that, beyond any doubt, he was at last approaching a city.

It was brilliantly illuminated by red artificial suns suspended in the sky, stretching out of sight along the horizon in either direction. In their slanting rays he saw a panorama as strange and wonderful as New York City would have seemed to Neanderthal Man.

There were no streets, only great buildings set in a widely spaced grid, on a plain made of some substance the color of deep ruby, sparkling with occasional flashes of light. Some of the structures were hemispherical domes, some resembled giant beehives, others were like overturned ships with their keels drawn upward into slender pinnacles. Though many were plain and angular, being based on a few simple elements, others were as complex as Gothic cathedrals or Cambodian temples; indeed, there was one group of buildings that reminded Bowman, very slightly, of Angkor Wat.

He first glimpsed the inhabitants from about a thousand yards away, as he was entering the outskirts of the city. There was a group of half a dozen, moving from one building to another, across the wide avenue that separated the structures. Though he could not yet judge their size accurately, he could see that they had two arms and legs, and walked upright. But even from a distance the head seemed most peculiar, and the method of locomotion was also odd. The creatures moved with a slow, fluid grace- almost as if forcing themselves through a heavy liquid. Compared with these beings, humans were jerky puppets.

It was soon obvious to Bowman that the city had no surface transportation; all its vehicles moved inside a narrow sandwich of space about fifty feet thick, and a hundred feet from the ground. He could see dozens of them, of many shapes and sizes, darting to and fro between the great towers, and he wondered how they managed to avoid collisions.

Then he noticed barely visible lines of light forming a colored network that extended right into the city, and radiated far beyond it. Some lines were scarlet, some blue, and they hung in the air like a grid of glowing wires. They were obviously not solid, for he could see objects through them.

Yet along those immaterial threads, either powered or controlled by them, the traffic of the city moved with unhesitating swiftness. The most common vehicles were small spheres, carrying one or two passengers; they looked like soap bubbles being driven by a gale, for they were perfectly transparent except for an opaque section of floor. There were two seats facing forward, and a small tapering column that presumably housed the controls. That was all; but Bowman knew that the nations of Earth would gladly pay billions for the secrets that must be concealed within them.

There were also considerably larger, oval-shaped vehicles that carried up to twenty passengers, as well as others which seemed used only for freight. Along one of the shining threads, hanging from it like raindrops on a spider's web but traveling at a good hundred miles an hour, shot a succession of spheres that contained nothing but reddish liquid. They raced past Bowman at perfectly regular intervals, heading out of sight into the city ahead of him.

He had already moved through the first line of buildings before he had a close view of the city's inhabitants. The capsule was traveling, at a height of about three hundred feet, past a great fluted cone, scalloped with little

balconies. And on one of these, his first extraterrestrial was standing in full view.

Bowman's initial impression was of a tall, extremely elongated human being, wearing a shining metallic costume. As he came nearer, he saw that this was only partly correct. The creature was more than eight feet tall, but it was quite unclothed.

That shining metal was its skin, which appeared to be as flexible as chain mail-or the scales of a snake, though the overall impression was not in the least reptilian. The head was utterly inhuman; it had two huge, faceted eyes, and a small, curled-up trunk of proboscis where the nose should have been. Though there was no hair, feathery structures grew where one would have expected to find the ears, and Bowman decided that these were sense organs of some kind.

He was passing within fifty feet of the creature, and despite the abnormal and curiously detached psychological state in which he had been ever since leaving Jupiter, he felt a sudden uprush of excitement, wonder-and sheer personal pride. He was the first of all men to look upon an intelligent extraterrestrial; that was an honor of which he could never be robbed. And he was not, as some of the more pessimistic exobiologists had predicted, either shocked or nauseated. Though this creature was certainly very strange, it was not horrible. Indeed, like all living things, it had its own internal logic and beauty; even at rest, it gave an impression of power and grace.

He had already passed the balcony when it occurred to him that the alien's behavior was rather odd. Even in a cosmopolis like this, it could not be every day that an outworlder went flying beneath your window, and Bowman assumed that he was the very first human being that anyone on this planet had ever seen. Yet the creature had ignored him completely.

He glanced back in time to see that he had not been ignored. This alien (no, he was the alien here) had dropped its pose of indifference, and was now looking directly at him. Moreover, it was holding a small metallic rod rather like a lorgnette against one eye. At first Bowman thought that the device was some optical aid; then he decided that he was having his photograph-or its equivalent-taken.

The creature lowered the instrument and ducked out of sight as the capsule sped away. Bowman was utterly unable to read its expression, and for the first time he realized how much training and experience was needed before one could interpret the emotions even of another human being; to read the thoughts of an alien from its attitude might be forever impossible.

The long-awaited First Contact had come and gone in a way which seemed both anticlimactic and rather mysterious; yet it was possible, Bowman reflected, that for these creatures this was a wild and tumultuous greeting.

When he had traveled farther into the city, he became quite sure that everyone was aware of his presence and that he was being studiously ignored. In the center of one avenue, for example, there was a small crowd gathered around a vertical sheet like a billboard or an illuminated sign. The board was covered with moving patterns and symbols, which were being studied with great attention; Bowman wondered whether they were conveying news, selling detergent, quoting interstellar rates of exchange, or announcing the departure of bubble-vehicles to distant spots.

Whatever the information, he would not have thought it more exciting than the passage of a stranger from space only a hundred feet overhead-yet the spectators ignored him. But as he sailed by, Bowman continued to watch them in the capsule's rear-view mirror, and saw that many of them were taking peeps at him over their shoulders. So they were mildly interested; even so, there were still quite a number who never bothered to look, but continued to stare intently at the patterns on the board.

He was now traveling directly down one of the wide avenues; ahead of him, the strange, humped buildings marched away into the distance until they blurred into the rosy mists of the horizon. Many were set with luminous panels so that they glowed like multicolored jewels. Others were covered with unbelievably intricate carvings or etchings, and Bowman could not help contrasting them with the stark glass-and-metal boxes of his own world. The architects of this planet, it seemed, built for the ages, the city appeared to be complete and finished, for nowhere was there any sign of construction or demolition. At first this surprised him; then he remembered that all terrestrial cities had been built by ephemeral, exploding societies, and he must now be observing a culture of a wholly different type.

Another proof of that lay in the spaciousness of the city; there was none of the hideous urban overcrowding so universal on Earth. That also was not surprising, for any really long-lived civilization had to have complete population control. It must have been thousands of years since these creatures had stabilized their society, and decided that it was better for a million to live in comfort than for ten million to starve in squalor. This was a lesson that his own world had been slow to learn.

Sometimes he observed, as in a distorting mirror, obvious reflections of terrestrial life. Though there were no traffic jams, frustrated motorists, or harried pedestrians he did see one stationary line of patient citizens waiting to enter a large domed structure. He wondered if they were first- nighters, bargain hunters, or enthusiasts for some wholly incomprehensible cause; it gave him a certain satisfaction to know that, even in the most advanced society, it was still sometimes necessary to wait in line.

And once he passed over what seemed to be a nursery school or a children's playground. He looked down at it with intense interest, for until now all the creatures he had seen in the streets had been adults. for the first time, it struck him as odd he had seen not a single specimen of their young.

But here they were, dozens of them-playing just like human children in a small park on the roof of a low, oval building. It was a charming, almost pastoral scene; there was a grove of trees that might have come from Earth, a plant like a gigantic orchid that obviously did not, a tiny lake with a fountain in its center, some mysterious machines that were being operated by small, intent figures- and a pair of grown-ups watching from a distance.

The children were all exactly the same size, Bowman judged them to be about five feet high. They looked as if they had been manufactured in an identical bath, and he wondered how these creatures reproduced. Despite their lack of any clothes except obviously functional harness that supported pouches, pockets, and occasional pieces of equipment, Bowman had seen no sign of sexual differentiation-or even of sex. Here was another of the thousands of questions he must file away, in the hope of one day finding the answer.

The children's reaction to his presence was wholly different from the adults'. As soon as the capsule passed over their playground, they at once abandoned their activities and stared up at him with obvious interest and excitement. Several pointed and waved; and one seemed to be aiming something like a small gun.

Bowman looked at this device uneasily. It reminded him of the toy "ray guns" he had played with as a child-and in a super-civilization like this, a toy might be capable of almost anything....

He flinched as the trigger was pulled, for it suddenly occurred to him that he might be regarded as expendable as a rabbit, to a boy given his first air rifle. But all that happened was that a shining silver vortex ring emerged from the gun, shot swiftly toward the capsule, and bounced off it harmlessly, still expanding.

There was a considerable commotion in the playground. The two adults advanced rapidly on the young marksman, who was promptly deprived of his toy.

A little later he passed close to a shopping center-or so, for want of a better name, he supposed it to be. It was a huge, irregular structure with dozens of setback floors, and at least fifty of the luminous sky-tracks led into it at various levels. Along these tracks moved a steady flow of the transparent spheres and ovoids, carrying goods of various kinds. It was strange to see, hurrying through the air, perfectly recognizable articles of furniture like tables and chairs-followed by utterly weird pieces of machinery, or tanks of glowing colored gas.

And nothing seemed to go into the building; objects only came out of it. Nor were there any customers, though that was not so surprising; even on backward Earth, most shopping was now done by TV.

The cameos he glimpsed, in his swift passage through the City, confused as much as enlightened him. Many of the buildings had large transparent areas, and through these he caught brief, tantalizing views of their inhabitants. Once he saw a large group of them standing around a circular trough, full of redly fuming liquid, sipping it through their flexible trunks. That was understandable enough; but what was the heavy green mist that formed a complete blanket over the lower half of the room?

And there was one building inside which gravity seemed to have gone mad. He could see planes of glittering material, like faintly shining glass, intersecting at all angles. Figures were walking between or along these planes, with a total disregard for the conventions of "up" and "down." Some were moving straight upward, some at forty-five degrees to the horizontal; and often they would switch nonchalantly through a right angle as their private gravity field tilted and a wall became a floor. Even to an astronaut who had spent much of his career in weightless conditions, the sight was very disturbing.

There was one completely transparent dome beneath which some kind of demonstration, or game, or artistic performance was in progress. A small circular arena was surrounded by a rather thin crowd of a few hundred spectators, seated in swiveling chairs. What they were looking at was a dazzling-and, to Bowman, eye-wrenching -exhibition of shapes and colors, as if a mad geometrician was displaying his wares.

Apparently solid figures appeared, merged into each other, changed their perspective, receded to infinity while still remaining at the same spot. Sometimes there were maddening glimpses of what might almost have been another dimension, sometimes surfaces which seemed to be convex suddenly became concave. Once or twice the spectators became very agitated, waving their slender arms in excitement, for no reason that Bowman could see.

The character of the city was changing; the buildings were becoming smaller and more widely spaced. But ahead of him, still several miles away and partly shrouded in the eternal light haze, was one enormous structure, by far the largest he had seen. From a central dome and spire radiated four main wings separated by four smaller ones, so that the plan of the building roughly resembled a compass rose or a gigantic starfish. It was, Bowman estimated, at least a mile across at the base; and he was traveling straight toward it.

Then his eye was distracted by another strange sight. The capsule was moving over what appeared to be a broad sheet of shining metal-but no metal, unless it was molten, was corrugated with ripples that traveled back and forth across its surface. He seemed to be flying over a lake of mercury.

The ripples were produced by small, turtle-shaped machines that moved with slow deliberation over the shining surface, they left behind them broad, corrugated tracks that took several seconds to fade away. And then a huge bulge appeared in the center of the lake, as a thing like a submarine-or a whale?-emerged, and sank back again into the depths.

Beyond the lake was, at last, something wholly understandable. That great reddish-bronze torpedo could only be a spaceship, so, probably, were the shining crystal spheres and ovoids parked beside it. Small surface vehicles were scurrying to and fro, tiny figures were walking around, and there was even an observation tower surmounted by strange devices and bearing a flashing light. Everywhere and everywhen, Bowman decided, spaceports and airports look much the same, but the fact that these people operated their ships inside city limits showed how far their technology was ahead of Earth's.

Even while he was passing, one of the crystal spheres began to ascend, as effortlessly and as silently as a balloon. It rose straight upward, at a perfectly constant speed, until it was lost in the darkness of the sky. Bowman's thoughts traveled with it, and for a few moments he was almost overwhelmed by a devastating nostalgia for Earth.

It swiftly passed, for now he had something else to think about. That gigantic star-shaped building was looming up ahead.

SCRUTINY

Now the capsule was climbing again, and the central tower was looming above him, like a mountain piercing the clouds. And it was a very strange mountain, for it seemed made of glass or crystal, shot through with myriads of dark lines and threads, along many of which moved tiny nodes of light-some slowly, some at dazzling speed.

As a swallow may glide into its nest high up among the spires and buttresses of some great cathedral, so the capsule merged into the central tower. What from a distance had seemed merely a detail of the intricate ornamentation expanded until it was a circular tunnel, about ten feet in diameter. It was a fairly close fit, but the capsule raced along it with unchecked speed and for the first

time Bowman noticed a blue line of light glimmering faintly in the air before him, presumably acting as his guide. The tunnel was driven through some translucent material, so that it seemed to Bowman that he was hurtling into the heart of an iceberg-if one could imagine an iceberg that coruscated not with blues and greens, but with pale reds and golds. He could glimpse other shapes moving around him in all directions, vertically and horizontally, apparently in adjoining tunnels, but it was impossible to see them clearly.

Then he burst out into a large cavity blown like a bubble in the ice. It was a roughly hemispherical chamber about a hundred yards across, with walls of constantly changing curvature, so that they were sometimes concave, sometimes convex. He was moving along a transparent plane about fifty feet above the floor, and there were other equally transparent planes above and below him.

Some were stationary, some mobile, carrying with them curious small structures and enigmatic pieces of machinery. The spectacle was confusing, yet orderly; and it was here, separated from him by the sliding crystal floors, that Bowman saw his first wholly non-humanoid intelligences.

Overhead, moving in a closely packed formation, were six squat cones, supported on dozens of tiny, tubelike legs. They looked rather like sea anemones walking on their tentacles, and Bowman could observe no signs of any sense organs. Around the middle of each cone was a white belt that seemed to be made of fur, and bore metal plates covered with angular hieroglyphics.

The capsule whisked past several of the snake-scaled humanoids, who this time turned to look at him with unconcealed interest. Then Bowman noticed, about two floors below, a most impressive creature like a giant praying mantis, hung with jewel-like ornaments or equipment, that went striding swiftly away, apparently quite oblivious to its surroundings. Its metallic limbs gleamed with the rainbow iridescence of a diffraction grating; Bowman had never seen anything so gorgeous, except for some of the tropical fish of coral reefs.

He passed quite close to one thing that could have been a robot, or a compound machine- organism, or perhaps a living animal made of metal. It looked like an elegant silvery crab, supported on four jointed legs, each of which terminated in a small, fat wheel; presumably the creature could walk or roll, whichever was more convenient. There was an ovoid body, into which various limbs were now retracted, and the whole was surmounted by a polyhedral head, each facet of which bore a deep-set lens.

There was one most disturbing entity on which he seemed unable to focus clearly. It was a gently pulsing golden flame, in the heart of which shone three intense and unwavering stars, like a triad of ruby eyes; unless Bowman's senses misled him completely, the thing kept disappearing and reappearing at intervals of a few yards, leaving behind it a ghostly afterimage which took a few seconds to fade away. He could not help wondering if he was looking at some being who existed, at least partly, in another dimension of space or time; there was certainly no remaining doubt that this city wag the meeting place of many worlds.

There were even some beings who were apparently vegetable. They did not move under their own power, but were supported in little tubs or pans, filled with a glistening, muddy substance out of which their tubular bodies sprouted. At first glance, they looked rather like weeping willows, and their thin yellow tendrils trembled continually as if with ague. They moved in a blaze of light, from a

ring of brilliant lamps arranged around them, so that whenever they traveled, they carried with them their own private suns.

Then he was through the great vaulted chamber and moving along another tunnel, this time a very short one. It ended in a low-ceilinged room, the roof of which appeared to be supported by six metal pillars arranged in a circle. The capsule glided between them, and settled down very gently on the floor, at the exact center of the circle.

So this, thought Bowman with a controlled but mounting excitement, is the end of the line. Someone-or something-had been to fantastic trouble to bring him here; and for what purpose? In a few minutes, he would know.

Almost at once he had the sensation of being watched; it was so powerful, so undeniable, that he twisted around and looked over his shoulder. But there was nothing here except the blankly shining pillars; he could not even see any sign of the tunnel through which he had come. The wall surrounding him was seamless and unbroken; there was no entrance, and no way out.

Then, like a fog creeping through a forest, something invaded his mind, and he knew himself in the presence of overwhelming intellectual power. Beneath that dispassionate scrutiny, he felt neither fear nor hope; all emotion had been leached away.

Out of the past, forgotten memories came flooding back, as if he was flicking through the pages of a snapshot album. He could see and hear and smell scenes from his childhood, in apparently total recall. Faces he did not even recognize flashed before him, as all the casual acquaintances and experiences of a lifetime went racing past, so swiftly now that he made no attempt to identify them. His whole life was unreeling, like a tape recorder playing back at hundreds of times normal speed.

Suddenly, like an illuminated glass model, he saw Discovery-in fantastic detail with all its veins and arteries of electrical wiring, fuel lines, air and hydraulic systems, control circuits. Some parts were sharp and clear, others fuzzy and blurred. These, he presently realized, were the areas with which he was not familiar, he could see nothing that he did not know. It was as if, for some unfathomable reason, he had set himself the task of mentally picturing the ship-and had succeeded in doing so to an extent altogether beyond his normal abilities. But that again might be an illusion; perhaps he only thought he was doing this-

And then came something that could not possibly be real. He was no longer inside the pod-or even inside his clothes. He was standing outside it, naked, looking through the window at his own frozen image at the controls.

Nor was that all. Though he could not alter the direction of his gaze, he knew that he was completely transfixed with a luminous, three-dimensional grid-a close-packed mesh of thin horizontal and vertical lines. For a moment he felt like a suspect in a police precinct, standing in front of a measuring chart. Then the impression passed as swiftly as it had come, and he was back inside the pod.

At the same instant, the vehicle was lifted off the floor, and carried silently out of the chamber, away from the ring of metal pillars. Once again it was swept along luminous corridors, once again Bowman saw the alien shapes coming and going in the passageways of the great hive around him-though now they

no longer seemed so strange. Then, before he had realized what was happening, he had shot out of the building and was rising vertically through the glowing submarine twilight. He caught one brief glimpse of the city through which he had passed; then it was lost in the mists below him as he was carried back toward the sky.

SKYROCK

The empty ocean rolled on beneath him, unmarked by ships or islands. Once or twice Bowman saw underwater shapes that might have been tightly packed schools of fish, or single marine beasts of appalling size; but nowhere was there any sign that this world held a civilization. He waited patiently, still under the influence of the strange euphoria that had gripped him when he left Jupiter V: he felt no hunger or fatigue, merely a vast and childlike wonder, and a readiness to accept anything that might come.

What came next was a long, low cloud-the first that Bowman had seen in this planet's pure and empty sky. Then, as it rose clear of the horizon, he realized that it was not cloud at all. Though its edges were irregular, they were sharply defined, it was also tinted with greens and browns and blacks, while here and there a few points sparkled like glass in the now almost level rays of the sun. And it seemed to be balanced at its center, like a one legged table, on a single slim blue-green column rising from the sea.

It was some time before Bowman, dazed with wonders, realized that everything he now saw was perfectly familiar-but impossibly located. That low cloud was an island, its edges showing somber hues of earth and rock and stone. He absorbed this fact thankfully; later, he might start to worry about the minor problem that it was hanging motionless in the sky, linked to the sea beneath only by the dubious support of an eternally descending waterfall.

As he drew nearer, the details of the floating land became sharper; he could see that much of it was covered with vegetation, above which metallic towers and white domed buildings projected at infrequent intervals. There was a range of low hills near the center, from one of them a thin plume of vapor spiraled gently up into the almost cloudless sky.

At the same moment, Bowman became aware of two other facts. One was that the central waterfall-as he had tentatively labeled it-showed no signs of movement. Though it seemed to be made of water, that water was motionless; it was a frozen column of liquid, two or three miles in height; and it merged without a splash into the unruffled sea.

The second fact was that the flying land was not alone; it was surrounded by dozens of small satellites, hovering equally fixed in the sky. No-not quite fixed, some were drifting very slowly in different directions, like ships making their way through a crowded harbor. And presently Bowman could see that they appeared small only because of their overwhelming background; for he was heading directly toward one, and it began to fill his sky.

The thing was a huge rock, or an uprooted mountain about a mile long and a thousand feet in thickness. Its flattened upper portion was elaborately landscaped into terraces and lawns and pools and little groves of exotic trees, with here and there wide open spaces in which stood enigmatic shapes that might have been statues, or motionless living creatures, or brooding machines. In one place a river flowed to the edge of the rock-yet refrained from leaping out into space toward the ocean miles below. Instead, it continued down and under the

rough, craggy surface, as if glued to it by some force more powerful than gravity.

And some such force must certainly be operating here- for all these millions of tons of rock were hanging unsupported in the sky. This microcosm of a world was poised between sea and space, one member of an archipelago of aerial islands.

There was sky above and below it, and a gentle wind was disturbing the branches of the strange trees, yet this flying rock seemed as firmly anchored in the empty air as if it rested upon some great mountain peak. And the pod was descending toward it.

It came to rest on a large, perfectly smooth lawn about a hundred feet square, surrounded by trees with foliage consisting of flat, circular plates, piled one above the other. The lawn was colored a bright green that at first sight seemed to be that of grass, but was really due to tiny plants like multi-leaved clover.

It was some time, however, before Bowman noticed such details, for he had eyes only for the other vehicle lying on this flat clearing among the trees. Iridescent apparently made of metal, it was a smooth projectile flaring to a point at either end. There were no windows, no sign of a door, no hint of any method of propulsion- only a few symmetrical bulges equally spaced around one end of the hull. Yet even in repose, it appeared ready to hurl itself at the stars; as Bowman gazed at it, he found to his surprise that his sense of wonder was not yet wholly satiated. There was a tingling in his blood as he stared at this symbol of power and speed, so close at hand. It was separated from him by only fifty feet of space; but by how many centuries of time?

Then his heart almost missed a beat; for he saw that there were people watching him from the shadow of the strange trees.

He did not hesitate to call them people, though by the standards of Earth they would have seemed incredibly alien. But already, his standards were not those of Earth he had seen too much, and realized by now that only a few times in the whole history of the Universe could the fall of the genetic dice have produced a duplicate of Man. The suspicion was rapidly growing in his mind-or had something put it there?-that he had been sent to this place because these creatures were as close an approximation as could readily be found to Homo sapiens, both in appearance and in culture.

There were five of them, and because he had no sense of scale it was some time before he realized that they were extremely tall-perhaps eight or nine feet high. Their bodies were quite slender, and roughly human in proportion, but he could not even guess at the details of their anatomy, because from the neck down they were completely covered by a network of phosphorescent threads that glittered and sparkled like a field of stars.

Even the fact that they possessed necks was not something that could be taken for granted; Bowman remembered the discussions he had heard about the advantages of fixed heads with omnidirectional vision. These creatures, however, followed the human pattern in having only two eyes, set in very large, elliptical sockets that sloped downward from where the nose should have been.

But here was no sign of a nose; even more astonishing, there was no mouth. Apart from those two rather beautiful eyes, placed far apart on a slightly oval

head whose long axis was not vertical, but horizontal, the face was quite featureless.

The general impression conveyed by the five entities, for all their weirdness, was not unattractive. The lovely golden-bronze color of the skin-if it was skin-helped to make them acceptable to human eyes. Bowman had been prepared for far worse-indeed, he had already seen it. He was sure that he would have no difficulty in adapting to these creatures, and perhaps becoming so accustomed to them that after a while the sight of another human being would be a shock.

Now what? he asked himself. Shall I wait for them to move, or are they waiting for me? They certainly seemed in no hurry, and might have been statues for all the activity they had shown so far.

Suddenly, there was a curious disturbance around the tallest of the five hominids. The glittering substance covering its left shoulder became humped and puckered; presently Bowman realized that some small, living creature was resting there. After a few ripples, the thing launched itself into the air, waving and fluttering like a tiny flying carpet, or a handkerchief blown before a breeze. It changed color as it flew; when it started, it was indistinguishable from the glittering phosphorescence on which it had been lying, but within seconds it became a gorgeous tapestry of reds and golds. Though it appeared too small, and moved too erratically, to be an intelligent being, it seemed to know where it was going, and presently it fluttered down onto the plastic dome of the capsule. Even at this close range, as he watched it crawling on the other side of his window, Bowman could not classify it in any branch of the known animal kingdom; it was merely an undulating sheet of color.

He continued to wait, and presently something strange happened to the capsule. The instruments on the little control board went suddenly crazy, the external manipulators flexed themselves as if testing their strength, and there was even a brief burst of power from the jets. It was as if a ghost had entered the machine, tested its operation, and, satisfied that it had discovered all that there was to know, abandoned it like a worn-out toy. But before it went, it operated one last circuit.

The little flying carpet must have known what was coming, for it abruptly took off and fluttered a few feet away. Seconds later, the emergency hatch blew out, and for the first time Bowman heard the sounds of this alien world.

Perhaps even the familiar noises of Earth would have seemed unreal, and hard to recognize, after his months in the artificial universe of Discovery. But there was one sound that no man could ever forget, as long as he lived it was the distant murmur of the sea-the eternal dialog between mind and wave.

It came from all around him-from the ocean that was two or three miles below, and which covered all this strange planet. That ocean, Bowman realized, must be very shallow; even if there was no dry land, there must be many reefs almost breaking the surface, to produce that endless susurration. If he closed his eyes, he could imagine that he was standing beside one of the far-off seas of Earth.

That was not the only sound, though it was the most prominent. There was also the faint sighing of the wind through the alien trees-and, from time to time, a trio of descending bell-like notes. It came from somewhere in the depths of the little wood that covered so much of this flying island; though it was strikingly

like the call of a bird, it seemed to have altogether too much power behind it for an avian origin.

Bowman sniffed cautiously at the air. He felt certain that these creatures would not have exposed him to their atmosphere unless they knew that he could breathe it. To his surprise, he could detect no change whatsoever; the air that flowed into his lungs was all too familiar. He could recognize the capsule's entire spectrum of odors from ozone through oil to sweat and pine-scented disinfectant.

Then he realized that he was still surrounded by an almost invisible envelope, like the one that had protected him on his journey. He wondered if it would permit him to leave the capsule, he had been offered the invitation and was only too glad to accept it, after all these hours in his cramped little world. He unstrapped himself, climbed out of the pod, and stretched his limbs with relief, while the tiny flying carpet fluttered overhead, circling around and around with obvious excitement.

Gravity seemed absolutely normal. He walked once around the capsule, getting the stiffness out of his limbs and enjoying this now almost forgotten mode of locomotion; the last time he had walked on an ordinary horizontal surface was a year ago, and unknown trillions of miles away. He felt like an invalid who had just been allowed out of bed after a long illness-reveling in his regained powers, but careful not to overexert them.

The faintly glimmering envelope, permeable to sounds but not to air, remained always a few feet away, changing its shape to accommodate him. It was as if he were inside a giant soap bubble, whose surface he could never quite reach, or even precisely locate. Presumably this was part of the decontamination procedure, and he wondered if he was a greater danger to this world than it was to him.

He looked questioningly toward the creatures still standing under the trees, and then, for the first time, one of them moved. It made a simple and unmistakable gesture, with the slowness of a dream, and Bowman realized that his time scale was not the same as theirs. Or perhaps they did not feel the need for haste; perhaps they had eternity at their command.

The tallest of the five hominids raised its right arm, and the network of glowing threads fell away to reveal a supple golden tube that divided in a rosette of eight symmetrically arranged tendrils, about a foot in length. It was exactly as if the creature's arm terminated in a sea anemone, and Bowman recalled, rather wryly, the arguments he had heard on Earth proving the universality of the hand-or something very much like it. In one of those moments of insight that come when one is confronted with the obvious, he realized where those arguments had gone hopelessly astray.

The human hand was a superb piece of engineering- but it was compromise. It was still designed to deal with heavy loads, to apply forces and pressures-to do mechanical work. Yet more and more, what was needed was precision and delicacy. Even for Man, the time of breaking branches and chipping flints had long since passed, the time of touching buttons and stroking keyboards had come.

Here, then, was the end of the hand's evolution. As he looked at those slim tendrils, Bowman was acutely conscious of his own stubby, clumsy fingers, and found himself involuntarily trying to conceal them by clenching his fist.

Then he realized that the creature was pointing, and he turned his head in the direction that it indicated. To his alarm and surprise, it seemed to be ordering him off the island-asking him to step over the edge of this floating rock, to fall down to the endless ocean miles below.

As if to reinforce this command, the little flying carpet was fluttering ahead of him, leading the way to the brink of the abyss. It was all very strange, but he still could not believe that any harm was intended to him. He followed his chromatic guide to the edge of the island, and peered cautiously over the side.

Before and below him was a curving rocky slope, rapidly becoming as steep as the roof of a house, then plunging completely out of sight. Down its face, and starting from a point only a few yards away from his feet, was a wide road of smooth gray material, following the curve of the rock until it too disappeared from view. It had an unmistakable impression of freshness, as if it had just been cut in the flanks of this aerial world.

Was this some kind of ordeal or test? Bowman asked himself. But that seemed altogether too naive and primitive a concept for a place like this. Then he remembered that he was in the presence of creatures who had mastered gravity; perhaps this downward-plunging road was not what it seemed.

He took a few gingerly steps along it, and the flying carpet fluttered encouragingly ahead. While he kept his eyes fixed on the pavement, he felt quite secure; so he took a dozen more paces.

He knew that the road was curving downward, ever more and more steeply; yet his senses told him that it was still quite horizontal. But when he risked a glance backward along the way he had come, the path in that direction was unmistakably downhill. There was no question of it; gravity tilted as he walked around this little world; wherever he was, the pavement beneath him was always horizontal.

He looked ahead-and was almost overcome by vertigo. For now it was the planet above which he was floating that had become crazy; as he walked down towards it, the ocean was a 45-degree slope running up the sky. With a great effort of will he ignored the illusion. After all, he was used to such things in space, Earth had looked like this, when he had been in dose orbit.

But there was a fundamental difference. Then he had been weightless-there was no direction of gravity. Here there was gravity, and it defied common sense.

He fixed his eyes on a point only a few yards ahead, and kept walking toward it. Now the trees and terraces on the upper part of the island had vanished completely, hidden by the curve of rock. Because he was looking at the ground, he almost ran into the building that barred his path.

It seemed as new as the road, which led directly to a rectangular green door just the right size to admit a man. Apart from this entrance, the side turned toward him was quite featureless, some thirty feet wide and fifteen high. And beyond it, a now absolutely vertical wall of water running up and down the sky, was the face of the ocean.

Somehow, he now found this easier to accept. Horizontal or vertical seas were all right; only the intermediate ones were hard on the nerves. But he did not wish to linger in this strange place for long, standing like a fly on a sheer

wall of rock. His brain told him that the powers and forces operating here were not likely to experience any sudden failure; a civilization would hardly build homes in the sky unless it felt utterly secure. His emotions, however, were still those of the primitive jungle ape, afraid that the branch to which he was clinging would snap.

His race had not yet made infallible machines, therefore, he could not really believe in their existence. The building ahead offered mental security, for it would shut out the view of that impossible sky.

At the door itself, he paused for a moment, wondering if there was anything that he had left in the capsule, up on the summit of the island. No, there was nothing there that would help; indeed, all the resources of Earth could not aid him here, if the powers of this world were bent on his destruction. He hesitated no longer, but walked steadfastly toward the green door; and it opened silently as he approached.

[In the next version (Chapters 40 to 42) Kubrick and I were getting close to our goal. We were still involved in fascinating, though dramatically irrelevant-not to say unfilmable-descriptions of extraterrestrial worlds. But we had begun to realize exactly what it was Bowman must meet, at the end of his journey....]

OCEANA

Not long afterward, he saw his first city. For some time the color of the ocean had been changing to a lighter hue, as if it was sloping up toward a continental shelf; and presently he was able to pick out markings on the seabed-including faint reticulations that might have been submerged highways. He thought he could see traffic moving along some of them.

Then the land humped up out of the sea in a great circle about ten miles across, exactly like a Pacific atoll. The ring of land was encrusted with brightly colored buildings, none of them very large or tall, and spaced at wide intervals. Prom a distance the ring-city looked disappointingly ordinary, and there was nothing to tell that it was made by a race other than man. Apart from a few very slim towers supporting wide, circular disks at a considerable height above the ground, there were none of the architectural fantasies that Bowman had half expected. Then he realized that there were only a limited number of sensible ways of enclosing space, which were the same throughout the universe; and there were very few designs, sensible or otherwise, that some enterprising architect had not already tried out on Earth.

However, the city had one strange characteristic: many of the buildings ran straight down into the sea, as if they had been built for amphibious creatures. There were no vehicles or aircraft, and Bowman was much too far away to glimpse any of the inhabitants.

But he did see one piquant detail before the circular island passed out of sight. The central lagoon was dotted with small moving objects which, even from this great distance, were quite unmistakable. The last thing that Bowman had ever expected to find on a world of such transcendental science was a sailboat, and the friendly reassuring sight of all that wholly useless activity filled his heart with warmth.

The sun, still framed within the arches of the rings, continued to sink; now it had almost reached the horizon. Fleeing from it, Discovery had come to the very edge of day-and, it appeared, to the edge of the sea, for the line dividing

water from sky was no longer a smooth, unbroken curve. It was splintered into dozens of sawtoothed peaks, as if a range of mountains was rising above the curve of the planet.

Yet these were no mountains, though they soared straight out of the sea to altitudes higher than the Himalayas. They were too regular and too symmetrical and their leaping towers and buttresses showed a total disregard for the structural laws that natural objects must obey. They marched on either side to north and to south, continuing out of sight as if they would meet again at the antipodes.

It was a spectacle to steal away the breath, and as he looked at those approaching peaks, already touched with the hues of night, Bowman thought how strange it was that he had reached the first continental landmass at the precise moment of sunset. Then he remembered another odd coincidence-that the circular forest of the skyplanets had been at the exact center of the planet's illuminated disk, directly beneath the sun.

Then the truth exploded suddenly in his mind. Ages ago this world had lost its rotation, and had come to rest with the same face always turned toward the double star around which it revolved. Now dawn and sunset stood together for eternity on the same unchanging meridian; along it these great peaks were the boundary markers between night and day, and forever faced the sun.

Discovery had descended below the level of the highest peaks, and was traveling, quite slowly, parallel to them at a distance of several miles. No two of the artificial mountains were identical in design; some were plain and angular, being constructed from a few simple elements, while others were incredibly complex, like Gothic cathedrals or Cambodian temples magnified fifty or a hundred times. There was no indication of age, they could have been built yesterday, or a million years ago. Nor was there any hint of their purpose, or indication that they were occupied. They might have been cities, or machines, or monuments, or tombs-or merely the follies of some omnipotent architect. They did nothing but stand and face that eternal dawn.

Now he could see, around the base of one of those approaching peaks, a glittering, crystalline fringe, as if intersecting sheets of glass were rising out of the ocean. Discovery was descending toward it; and Bowman saw that, at last, he was entering a city.

That word was misleading, but he could think of no better one. His first impression was of emptiness and space; there were no packed, scurrying throngs of anxious commuters, no crowded roads and sidewalks. It was some time, indeed, before he could see any sign of life or movement at all.

The ship was passing between vertical planes of some metallic substance that seemed to change its texture with the angle of view. At one moment it would be as flat and featureless as polished steel then it would become flooded with iridescent, rainbow colors, behaving like a giant diffraction grating. Some areas were transparent; and through these, Bowman first glimpsed one of the city's inhabitants.

Ironically, yet not surprisingly, it was looking at him. Even on this world, thought Bowman, it could not be a common event for a two-hundred-foot-long alien space vehicle to go drifting past your window....

The thing was either a robot, or a compound machine organism; it looked like an elegant metal crab, supported on four jointed legs. Each of those legs terminated in a small, fat wheel; presumably the creature could walk or roll, whichever was more convenient. There was an ovoid body, into which various limbs were now retracted, and the whole was surmounted by a polyhedral head, each facet of which bore a deep-set lens.

The body never moved, but the head rotated steadily to follow him as he passed by. Bowman tried to look into the room behind the creature, but he could see only a moving patchwork quilt of soft, pastel colors-whether a work of art, or a scientific experiment, he could not guess.

A little later he saw another of these metal entities, but in quite a different environment. It was in the center of a small circular auditorium or amphitheater, which was flooded with some greenish foam to a depth of two or three feet. Rising out of the foam were little trees, like weeping willows or aspens, whose long, delicate leaves trembled continually, as if afflicted with ague. At the highest point of each stem was something that closely resembled an orchid; but it was an orchid with tiny, staring eyes, and fine tendrils that kept twisting and twining like nervous fingers. It was impossible to avoid the conclusion that these were intelligent plants, talking to each other-or to the robot-in some complex sign language.

Discovery was now drifting between walls of glass or metal that rose straight out of the sea, and immediately ahead was a fountain or waterspout that rose to a height of at least two hundred feet and then fell back into a huge circular moat that surrounded it like a halo. From this moat transparent tubes ran off in several directions, and as he approached, Bowman saw that this was not merely a piece of ornamental hydraulics; it was part of a sea-to-air transportation system.

Every few minutes there would be a flicker of darkness in the ascending column, and something like a large fish would splash into the moat, then go shooting off along one of the radiating tubes. Bowman was not surprised when he recognized the intelligent suckerfish he had seen among the roots of the skyplants, but there were also a few creatures remarkably like dolphins and seals. All seemed to know exactly where they were going, and once, a pair of the dolphinoids, apparently out of pure exuberance, leaped straight out of the moat and back into the sea. At the end of the two- hundred-foot dive, their gleaming bodies entered the water simultaneously with scarcely a splash.

This city seemed to have been designed for common use by creatures of the sea and the land-yet so far, he had seen nothing even remotely resembling a human being. Was it possible that, despite all the arguments of the exobiologists, the hominid shape was actually quite rare in the universe-perhaps even unique?

A few minutes later, he had the answer to that question.

INTO THE NIGHT LAND

The creature standing on the balcony below which the ship was now moving possessed two arms, two legs, a vertical torso supporting an ovoid head, and two eyes; almost all the main ingredients of the human body were there, and in approximately the right places. Yet the total result was completely alien, and for the first time Bowman realized how many variations were possible on the basic human design. The biologists had told him this, but he had never really believed it.

The thing was only about five feet tall, and was very stocky, as if it came from a planet with a high gravity. Two large eyes, protected by bony ridges, were set on almost opposite sides of the head. But there was nothing that could be called a face; he could see no sign of mouth, nostrils, or ears. How did the thing manage to eat and breathe? It appeared to be a living creature; presumably it had some kind of metabolism.

Then Bowman looked more carefully at the two small, dark patches which he had assumed were nipples-and he realized how dangerous it was to jump to conclusions about extra terrestrials. These were the nostrils, sensibly located at the nearest point to the lungs. There was no doubt of it; the two small pits were opening and closing with a slow, regular rhythm.

But where was the mouth? For a moment, still conditioned by his human prejudices, Bowman searched in vain. Then he remembered the lesson of the nostrils, asked himself where a competent efficiency expert would put the mouth, and had his answer.

The creature was wearing a somewhat elaborate dress that covered the body up to about a foot below the neck; it hung by straps from a metal collar, and looked rather comically like a giant kilt, complete with sporran in the region of the navel-not that Bowman now imagined for a moment that the creature had a navel.

That "sporran" was really a kind of movable curtain or screen; and beneath it, Bowman was quite sure, would be the mouth, handily placed at the entrance to the stomach. He decided that he would not care to be invited to dinner by these entities, but he had to admit that their alimentary arrangements were more efficient than his. They would doubtless be revolted by his all-purpose eating-speaking breathing organ, permanently exposed to public view.

He wondered how the creature communicated with its kind; perhaps it did not rely on sound at all. Then he remembered that many animals on earth had no visible organs of sound production or detection, and that the absence of external ears proved nothing.

The creature had been watching him as the ship passed beneath its balcony, and at the moment of closest approach it did something completely human. It reached into one of the pockets of its dress, brought out a small metallic box, and raised it to its eyes. It held it there for a few seconds, then put it away again; and Bowman realized that he had had his photograph taken by a collector of biological curiosities.

The ship was now moving slowly through the outskirts of the city, obviously according to some prearranged plan. Was he being shown to its people, or were they being shown to him? His arrival had certainly attracted little attention; he thought of all the crowds that would have gathered on Earth if an alien spaceship had landed. However, it was obvious that this planet was inhabited- or visited-by intelligent creatures of many races; it was also possible that they were too polite to stare at strangers.

He was wrong on that count, as he soon discovered Skirting the edge of a large, circular courtyard or patio; he noticed his first crowd. It was a sparse one, containing not more than a hundred entities of at least six basic types. Besides the two varieties he had already seen, there were tall, slender creatures of almost human form, but with blank, egglike heads absolutely devoid

of features. There were also squat cones, supported on dozens of tiny tubelike legs; and there was one impressive thing like a giant praying mantis.

They were all looking (though how the apparently eyeless eggheads managed this was more than Bowman could imagine) at a large bubble hanging in midair at the center of the patio; and in that bubble was-at last-the image of a perfectly normal human face. For a few seconds he looked at it with all the relief of a lost traveler meeting a fellow countryman in a far land; then, with a jarring psychic shock, he realized how totally disoriented he had become.

The face was his own; he had failed to recognize himself.

The mouth inside the bubble fell slackly; then Bowman pulled himself together. You've been on TV before, he told himself wryly; this is no time to get camera fright. (But where the devil was the camera?) Then the scale of the picture changed, so that he could see the whole interior of the cabin. The invisible eye retreated until it seemed that a scale model of Discovery was floating there before the intent little group of spectators. Bowman wondered how long they had been looking at him, and how much they had already seen.

Then the ship moved on, and he lost sight of his audience, though he remained highly conscious of it. He did not see himself again.

The feeling of confident well-being that had gripped him was beginning to wear off, he had seen too much too swiftly, and was becoming punch-drunk with sensations. One fact that added to the mental strain was something that he had never anticipated; he simply had no words for many of the things he was seeing, and this made it impossible for him to marshal his thoughts and to put his experiences in order. He had to make up labels as he went along, but he knew that they were only temporary, perhaps even misleading. Some of the creatures he had hastily classed as hominid might well be less human than the robots (if they were robots). And on this world, there might no longer be any real distinction between intelligences housed in machines, and those that occupied bodies of flesh and blood.

The passing scenes began to blur in his mind, and on several occasions he blanked out for unknown periods of time. For once he found himself sinking down a huge vertical shaft surrounded by water, and had no idea how he had got here. At first he thought that the water was held back by a cylindrical wall of glass or transparent plastic-but then one of the porpoise creatures came shooting straight through the barrier, into the column of air down which Discovery was slowly falling.

The dolphinoid drifted across the well, keeping level with the ship and obviously inspecting it closely. It reached the other side, merged without resistance into the wall of water, and shot off effortlessly with a flurry of flukes.

Not only the laws of matter but the law of gravity seemed to have been repealed in this strange place. Bowman could see many other tunnels heading off into the distance through the incredibly clear water; some were vertical, some horizontal-and the inhabitants of the city were moving along them both with a total disregard for the conventions of "up" and "down." It was not a question of the weightlessness with which he was familiar in space; judging by the way they were standing, the creatures in these tunnels had normal weight, and appeared completely at ease. Where one tunnel had intersected another in the vertical

plane, they would switch nonchalantly through a right angle as the gravity field tilted and a wall became a floor.

It was a very disconcerting sight; but doubtless an escalator would have appeared just as unsettling to a Neanderthal Man.

The well down which he was sinking was perhaps five hundred feet deep, and ended in one of the underwater patios of this amphibious city. He could see, fading away into the blue distance, lines of open structures which he could only describe as roofless-and largely wall-less- buildings. The creatures he had called suckerfish were swimming in and out of these submarine apartments; most of them were moving under their own power, but a few were operating small torpedolike machines. Bowman had never imagined that he would one day see fish riding scooters; and even when he contemplated this thought, it still didn't seem funny.

The suckerfish were very inquisitive, they gathered around in scores, peering into the ship, and they spiraled up with him when Discovery started to rise again, past that vista of radiating tunnels.

The hole in the water widened as it approached the surface; he seemed to be emerging from a kind of stationary whirlpool in the center of a small lake. There were smaller whirlpools orbiting around it, like planets around the sun, and Bowman wondered if they were part of a mobile, liquid sculpture. He could not imagine what other purpose they fulfilled.

And then he was flying over what must have been a residential area, for beneath him were roads that rolled briskly along like moving belts, between wide-spaced buildings no two of which were of the same design-or even, as he presently realized, built to the same scale. Some would not have looked out of place in a housing estate on Earth, but there were others that resembled small chemical processing plants and were presumably occupied by creatures with peculiar domestic requirements. Some were made for giants; others for beings who could hardly be larger than pygmies. And there was one wide, flat pancake of a building whose roof was not more than two feet from the ground....

As Bowman passed over this suburban area-though, in reality, the whole city was a giant suburb-he caught tantalizing glimpses of the life it housed. It was obvious that, to some of its inhabitants, privacy meant absolutely nothing; their homes were as transparent as goldfish bowls. Once he looked into a room where three iridescent beetles, as large as a man, were standing around a bowl of redly fuming liquid, sipping it through flexible trunks or proboscises. In another, dozens of things like giant grubs were busily weaving a web around a cocoon that must have been ten feet long, and vibrated slightly from time to time.

And he saw more of the intelligent plants, standing in troughs of green mud, and swaying ecstatically as they absorbed the rays from a brightly shining globe. Even as he watched, one of the creatures seemed to explode in a cloud of mist, which resolved itself into tiny white parachutes. As they drifted slowly to the ground, Bowman realized that he had witnessed birth and death, but not as humans knew either.

Now the city, with all its meaningless wonders, its mind-wracking vistas, and its fantastic inhabitants, was falling behind him; he could relax once more with the spectacle of those calm, magnificent peaks, gilded by the faintly aureate

glow of the eternal dawn. Discovery was moving past them at a considerable speed, racing along the edge of night.

The sky ahead was changing; there was a mist spreading across the horizon, thickening into a great river of cloud. It seemed to form somewhere out in the darkness, and then to flow toward the line of day. Quite abruptly, it plunged downward, in an immense and silent cataract flanked by two of the mountain towers-a slow-moving Niagara, five miles high and fifty miles across. The illusion of falling water was almost perfect; but this avalanche of mist slid down the sky with a dreamlike lethargy, and merged without a splash into the unruffled sea.

The mountain-towers dropped behind him, and the last light of the sun faded from the sky. (How many millions of years, he wondered, since it had shone upon this land?) But the white rainbow of the rings, and two large crescent moons, provided plenty of cold illumination, he could see clear to the horizon, and it seemed that he was flying over a vast snow field rather than a sea of clouds. He had once orbited across the Antarctic under a full moon, only a hundred miles up; it required little effort to imagine that he was back there, waiting to exchange greetings with Mirny or McMurdo....

He passed one mountain, and that a very strange one. It jutted up above the clouds like a giant iceberg-though no structure of ice could possibly be so tall, or so transparent. He could see far into its interior, which was laced with veins of some dark material; though he could not be certain, it seemed that some of these veins pulsed slowly, giving him the impression that he was looking into a gigantic anatomical model. Or perhaps it was not a model, but the real thing, whatever that might be; but this was a thought on which he did not care to dwell.

Then there was only the level sea of cloud-and, just once, a great glowing patch like the lights of a city hidden by the overcast. Presently it too fell astern, and he was alone under the arches of the rings, and the utterly alien stars.

He had now almost completed one half-circuit of this world, and was nearing the center of the nightside. It was easy to tell this, for the great bite taken out of the rings by the eclipsing shadow of the planet was now exactly overhead; he was as far from the forest of the sky plants as he could travel, while still remaining on this world. If he continued on this course, he would be heading back into the day.

Something was eclipsing the stars-something utterly black, rising swiftly up the sky. For an instant he thought it was a mountain, Lying directly in his path; but no natural substance could soak up light as did this column of Stygian darkness. He caught only the faintest gleam from the mingled rays of the two moons, glancing upon fluted, cylindrical walls like polished ebony; and even as Discovery hurtled into the thing, beyond all possibility of avoidance, a long-forgotten line of poetry surged up from the depths of his memory. He found himself repeating desperately, like an incantation to ward off disaster: "Childe Harold to the Dark Tower came."

Then the Dark Tower was upon him, and his only regret was that he had seen so much and learned so little.

There was no impact and no sound, but the stars and the clouds were gone. Instead, the ship was moving through an infinite lattice of softly glowing

lights-a misty, three-dimensional grid which appeared to have neither beginning nor end. For a moment Discovery seemed to coast forward on its own momentum; then it began to fall.

Faster and faster, the arrays of light went flickering by, as Discovery plunged downward at ever-accelerating speed. Without astonishment-for he was now beyond such an emotion-Bowman saw that the nodes of luminescence were passing through the solid walls of the ship as they raced upward; indeed, he could see them streaming through his own body.

Now he was falling through the grid so swiftly that the individual knots of light could no longer be seen; they were merely pulsations in the lines that went flickering vertically past. He must have descended for miles; by this time, surely, he was far below the surface of the planet- if he was moving through real space at all.

Suddenly, the shining lattice was gone; he was falling toward darkness, out of a dully glowing sky. And on that darkness, the ship came at last to rest.

It was a place without horizons, or any sense of scale. A hundred feet or a hundred miles above his head was a flat, endless plane, very much like the surface of the red dwarf star from which he had emerged into this solar system. It was cherry red, and little nodules of brighter luminescence appeared at random, wandered around for a while like living things, and then faded out into the glowing background. If Bowman had possessed a trace of superstition, he could easily have imagined that this was the roof of Hell. There was no mark to show how he had passed through it, to enter this underworld.

He waited, on an infinite black plain, beneath an infinite glowing sky. And presently, for the first time in all his travels, he heard a sound.

It was a gentle throbbing, like the beating of a drum, that grew louder and more insistent second by second. He did not attempt to fight its compulsion, but let its hypnotic rhythm take over control of his mind.

And now, light was appearing in the aching darkness of the plain. First there was a single star, that moved swiftly to trace out a line, then the line moved, to make a horizontal square; then the square lifted, leaving its presence where it had passed, until the ghost of a crystal cube hung before Bowman's eyes.

The drumming became louder, more complex. Now there were rhythms moving against each other, like clashing waves on the surface of a stormy sea. And the crystal cube began to glow.

First it lost its transparency and became suffused with a pale mist, within which moved tantalizing, ill-defined phantoms. They coalesced into bars of light and shadow, then formed intermeshed, spoked patterns that began to rotate.

Now the turning wheels of light merged together, and their spokes fused into luminous bars that slowly receded into the distance. They split into pairs, and the resulting sets of lines started to oscillate across each other, continually changing their angle of intersection. Fantastic, fleeting geometrical patterns flickered in and out of existence as the glowing grids meshed and unmeshed, and the hominid watched from its metal cave-wide-eyed, slack jawed, and wholly receptive.

The dancing moire patterns suddenly faded, and the rhythm sank to a barely audible, almost subsonic, pulsing throb. The cube was empty again; but only for a moment.

The first lesson having been moderately successful, the second was about to begin.

EPILOGUE

And so at last, after many adventures, Odysseus returned home, transformed by the experiences he had undergone....

What lies beyond the end of 2001, when the Star Child waits, "marshaling his thoughts and brooding over his still untested powers," I do not know. Many readers have interpreted the final paragraph to mean that he destroyed Earth, perhaps in order to create a new Heaven. This idea never occurred to me; it seems clear that he triggered the orbiting nuclear bombs harmlessly, because "he preferred a cleaner sky."

But now, I am not so sure. When Odysseus returned to Ithaca, and identified himself in the banqueting hall by stringing the great bow that he alone could wield, he slew the parasitical suitors who for years had been wasting his estate.

We have wasted and defiled our own estate, the beautiful planet Earth. Why should we expect any mercy from a returning Star Child? He might judge all of us as ruthlessly as Odysseus judged Leiodes, whose "head fell rolling in the dust while he was yet speaking"-and despite his timeless, ineffectual plea, "I tried to stop the others." Few indeed of us would have a better answer, if we had to face judgment from the stars. And such a Dies Irae may be closer than we dream; for consider these facts.

It is now some twenty years since our first superpowered radars began announcing to the Universe that a technological culture has arisen on Earth. By this time, therefore, those signals will have passed stars twenty lightyears away, and they will still be detectable when they have traveled much greater distances. How many civilizations already know of our existence? How many feel concerned-and are prepared to take some action? One can only guess.

Yet we know that the electronic birthcries of our culture have already reached at least a hundred suns, all the way out to giant Vega. By the year 2001, there will have been ample time for many replies, from many directions.

And there will have been time for more than that. Despite assertions to the contrary, from scientists who should have learned better by now, an advanced technology should be able to build ships capable of reaching at least a quarter of the speed of light. By the turn of the millennium, therefore, emissaries could be arriving from Alpha Centauri, Sirius, Procyon....

And so I repeat the words I wrote in 1948:

I do not think we will have to wait for long.

Colombo - December 31, 1970

The Next Tenants

Arthur C. Clarke

"The number of mad scientists who wish to conquer the world," said Harry Purvis, looking thoughtfully at his beer, "has been grossly exaggerated. In fact, I can remember encountering only a single one."

"Then there couldn't have been many others," commented Bill Temple, a little acidly. "It's not the sort of thing one would be likely to forget."

"I suppose not," replied Harry, with that air of irrefragable innocence which is so disconcerting to his critics. "And, as a matter of fact, this scientist wasn't really mad. There was no doubt, though, that he was out to conquer the world. Or if you want to be really precise-to let the world be conquered."

"And by whom?" asked George Whitley. "The Martians? Or the well-known little green men from Venus?"

"Neither of them. He was collaborating with someone a lot nearer home. You'll realize who I mean when I tell you he was a myrmecologist."

"A which-what?" asked George.

"Let him get on with the story," said Drew, from the other side of the bar. "It's past ten, and if I can't get you all out by closing time this week, I'll lose my license."

"Thank you," said Harry with dignity, handing over his glass for a refill. "This all happened about two years ago, when I was on a mission in the Pacific. It was rather hush-hush, but in view of what's happened since there's no harm in talking about it. Three of us scientists were landed on a certain Pacific atoll not a thousand miles from Bikini, and given a week to set up some detection equipment. it was intended, of course, to keep an eye on our good friends and allies when they started playing with thermo-nuclear reactions -to pick some crumbs from the A.E.C.'s table, as it were. The Russians, naturally, were doing the same thing, and occasionally we ran into each other and then both sides would pretend that there was nobody here but us chickens.

"This atoll was supposed to be uninhabited, but this was a considerable error. It actually had a population of several hundred millions-"

"What!" gasped everybody.

"-several hundred millions," continued Purvis calmly, "of which number, one was human. I came across him when I went inland one day to have a look at the scenery."

"Inland?" asked George Whitley. "I thought you said it was an atoll. How can a ring of coral-"

"It was a very plump atoll," said Harry firmly. "Anyway, who's telling this story?" He waited defiantly for a moment until he had the right of way again.

"Here I was, then, walking up a charming little river-course underneath the coconut palms, when to my great surprise I came across a waterwheel-a very modem-looking one, driving a dynamo. If I'd been sensible, I suppose I'd have gone back and told my companions, but I couldn't resist the challenge and decided to do some reconnoitering on my own.' I remembered that there were still supposed to be Japanese troops around who didn't know that the war was over, but that explanation seemed a bit unlikely.

"I followed the power-line up a hill, and there on the other side was a low, whitewashed building set in a large clearing. All over this clearing were tall, irregular mounds of earth, linked together with a network of wires. It was one of the most baffling sights I have ever seen, and I stood and stared for a good ten minutes, trying to decide what was going on. The longer I looked, the less sense it seemed to make.

141 was debating what to do when a tall, white-haired man came out of the building and walked over to one of the mounds. He was carrying some kind of apparatus and had a pair of earphones slung around his neck, so I guessed that he was using a Geiger counter. It was just about then that I realized what those tall mounds were. They were termitaries . . . the skyscrapers, in comparison to their

makers, far taller than the Empire State Building, in which the so-called white ants live.

"I watched with great interest, but complete bafflement, while the elderly scientist inserted his apparatus into the base of the termitary, listened intently for a moment, and then walked back towards the building. By this time I was so curious that I decided to make my presence known. Whatever research was going on here obviously had nothing to do with international politics, so I was the only one who'd have anything to hide. You'll appreciate later just what a miscalculation that was.

"I yelled for attention and walked down the hill, waving my arms. The stranger halted and watched me approaching: he didn't look particularly surprised. As I came closer I saw that he had a straggling moustache that gave him a faintly Oriental appearance. He was about sixty years old, and carried himself very erect. Though he was wearing nothing but a pair of shorts, he looked so dignified that I felt rather ashamed of my noisy approach.

"'Good morning, I said apologetically. 'I didn't know that there was anyone else on this island. I'm with an-er-scientific survey party over on the other side.'

"At this, the stranger's eyes lit up. 'Ah,' he said, in almost perfect English, 'a fellow scientist! I'm very pleased to meet you. Come into the house.4

"I followed gladly enough-I was pretty hot after my scramble -and I found that the building was simply one large lab. In a comer was a bed and a couple of chairs, together with a stove and one of those folding wash-basins that campers use. That seemed to sum up the living arrangements. But everything was very neat and tidy: my unknown friend seemed to be a recluse, but he believed in keeping up appearances.

"I introduced myself first, and as I'd hoped he promptly responded. He was one Professor Takato, a biologist from a leading Japanese university. He didn't look particularly Japanese, apart from the

moustache I've mentioned. With his erect, dignified bearing he reminded me more of an old Kentucky colonel I once knew.

"After he'd given me some unfamiliar but refreshing Wine, we sat and talked for a couple of hours. Like most scientists he seemed happy to meet someone who would appreciate his work. It was true that my interests lay in physics and chemistry rather than on

the biological side, but I found Professor Takato's research quite fascinating.

"I don't suppose you know much about termites, so IT remind you of the salient facts. They're among the most highly evolved of the social insects, and live in vast colonies throughout the tropics. They can't stand cold weather, nor, oddly enough, can they endure direct sunlight. When they have to get from one place to another, they construct little covered roadways. They seem to have some unknown and almost instantaneous means of communication, and though the individual termites are pretty helpless and dumb, a whole colony behaves like an intelligent animal. Some writers have drawn comparisons between a termitary and a human body, which is also composed of individual living cells making up an entity much higher than the basic units. The termites are often called 'white ants', but that's a completely incorrect name as they aren't ants at all but quite a different species of insect. Or should I say 'genus'? I'm pretty vague about this sort of thing . . . .

"Excuse this little lecture, but after I'd listened to Takato for a while I began to get quite enthusiastic about termites myself. Did you know, for example, that they not only cultivate gardens but also keep cows-insect cows, of course-and milk them? Yes, they're sophisticated little devils, even though they do it all by instinct.

"But I'd better tell you something about the Professor. Although he was alone at the moment, and had lived on the island for several years, he had a number of assistants who brought equipment from Japan and helped him in his work. His first great achievement was to do for the termites what von Frische had done with bees-he'd learned their language. It was much more complex than the system of communication that bees use, which as you probably know, is based on dancing. I understood that the network of wires linking the termitaries to the lab not only enabled Professor Takato to listen to the termites talking among each other, but also permitted him to speak to them. That's not really as fantastic as it sounds, if you use the word "speak" in its widest sense, We speak to a good many animals-not always with our voices, by any means. When you throw a stick for your dog and expect him to run and fetch it, that's a form of speech-sign language. The Professor, I gathered, had worked out some kind of code which the termites

understood, though how efficient it was at communicating ideas I didn't know.

"I came back each day, when I could spare the time, and by the end of the week we were firm friends. It may surprise you that I was able to conceal these visits from my colleagues, but the island was quite large and we each did a lot of exploring. I felt somehow that Professor Takato was my private property, and did not wish to expose him to the curiosity of my companions. They were rather uncouth characters-graduates of some provincial university like Oxford or Cambridge.

"I'm glad to say that I was able to give the Professor a certain amount of assistance, fixing his radio and lining up some of his electronic gear. He used radioactive tracers a good deal, to follow individual termites around. He'd been tracking one with a Geiger counter when I first met him, in fact.

"Four or five days after we'd met, his counters started to go haywire, and the equipment we'd set up began to reel in its recordings. Takato guessed what had happened: he'd never asked me exactly

what I was doing on the islands, but I think he knew. When I greeted him he switched on his counters and let me listen to the roar of radiation. There had been some radioactive fall-out-not enough to be dangerous, but sufficient to bring the background way up.

"'I think,' he said softly, 'that you physicists are playing with your toys again. And very big ones, this time.'

"'I'm afraid you're right,' I answered. We wouldn't be sure until the readings had been analyzed, but it looked as if Teller and his team had started the hydrogen reaction. 'Before long, we'll. be able to make the first A-bombs look like damp squibs.'

"'My family,' said Professor Takato, without any emotion, 'was at Nagasaki.'

"There wasn't a great deal I could say to that, and I was glad when he went on to add: 'Have you ever wondered who will take over when we are finished?'

"'Your termites? I said, half facetiously. He seemed to hesitate for a moment. Then he said quietly, 'Come with me; I have not shown you everything.'

"We walked over to a comer of the lab where some equipment lay concealed beneath dust-sheets, and the Professor uncovered a

rather curious piece of apparatus. At first sight it looked like one of the manipulators used for the remote handling of dangerously radioactive materials. There were handgrips that conveyed movements through rods and levers, but everything seemed to focus on a small box a few inches on a side. 'What is it? I asked.

"'It's a micromanipulator. The French developed them for biological work. There aren't many around yet.'

"Then I remembered. These were devices with which, by the use of suitable reduction gearing, one could carry out the most incredibly delicate operations. You moved your finger an inch-and the tool you were controlling moved a thousandth of an inch. The French scientists who had developed this technique had built tiny forges on which they could construct minute scalpels and tweezers from fused glass. Working entirely through microscopes, they had been able to dissect individual cells. Removing an appendix from a termite (in the highly doubtful event of the insect possessing one) would be child's play with such an instrument.

"'I am not very skilled at using the manipulator,' confessed Takato. 'One of my assistants does all the work with it. I have shown no one else this, but you have been very helpful Come with me, please.'

"We went out into the open, and walked past the avenues of tall, cement-hard mounds. They were not all of the same architectural design, for there are many different kinds of termites-some, indeed, don't build mounds at all. I felt rather like a giant walking through Manhattan, for these were skyscrapers, each with its own teeming population.

"There was a small metal (not wooden-the termites would soon have fixed that!) hut beside one of the mounds, and as we entered it the glare of sunlight was banished. The Professor threw a switch, and a faint red glow enabled me to see various types of optical equipment.

"'They hate light,' he said, 'so it's a great problem observing them. We solved it by using infra-red. This is an image-converter of the type that was used in the war for operations at night. You know about them?

"'Of course,' I said. 'Snipers had them fixed on their rifles so that they could go sharp-shooting in the dark. Very ingenious things -I'm glad you've found a civilized use for them.'

"It was a long time before Professor Takato found what he wanted. He seemed to be steering some kind of periscope arrangement, probing through the corridors of the termite city. Then he said: 'Quick-before they've gone!'

"I moved over and took his position. It was a second or so before my eye focused properly, and longer still before I understood the scale of the picture I was seeing. Then I saw six termites, greatly enlarged, moving rather rapidly across the field of vision. They were traveling in a group, like the huskies forming a dog-team. And that was a very good analogy, because they were towing a sledge . . . .

"I was so astonished that I never even noticed what kind of load they were moving. When they had vanished from sight, I turned to Professor Takato. My eyes had now grown accustomed to the faint red glow, and I could see him quite well.

"'So that's the sort of tool you've been building with your micromanipulator!' I said. 'It's amazing-I'd never have believed it.'

"'But that is nothing,' replied the Professor. 'Performing fleas will pull a cart around. I haven't told you what is so important. We only made a few of those sledges. The one you saw they constructed themselves.'

"He let that sink in: it took some time. Then he continued quietly, but with a kind of controlled enthusiasm in his voice: Remember that the termites, as individuals, have virtually no intelligence. But the colony as a whole is a very high type of organism -and an immortal one, barring accidents. It froze in its present instinctive pattern millions of years before Man was born, and by itself it can never escape from its present sterile perfection. It has reached a dead-end-because it has no tools, no effective way of controlling nature. I have given it the lever, to increase its power, and now the sledge, to improve its efficiency. I have thought of the wheel, but it is best to let that wait for a later stage-it would not be very useful now. The results have exceeded my expectations. I started with this termitary alone-but now they all have the same tools. They have taught each other, and that proves they can cooperate. True, they have wars-but not when there is enough food for all, as there is here.

"'But you cannot judge the termitary by human standards. What I hope to do is to jolt its rigid, frozen culture-to knock it out

of the groove in which it has stuck for so many millions of years. I will give it more tools, more new techniques-and before I die, I hope to see it beginning to invent things for itself.'

"'Why are you doing this? I asked, for I knew there was more than mere scientific curiosity here.

"'Because I do not believe that Man will survive, yet I hope to preserve some of the things he has discovered. If he is to be a dead-end, I think that another race should be given a helping hand. Do you know why I chose this island? It was so that my experiment should remain isolated. My super termite, if it ever evolves, will have to remain here until it has reached a very high level of attainment. Until it can cross the Pacific, in fact . . . .

"'There is another possibility. Man has no rival on this planet. I think it may do him good to have one. It may be his salvation.'

"I could think of nothing to say: this glimpse of the Professor's dreams was so overwhelming-and yet, in view of what I had just seen, so convincing. For I knew that Professor Takato was not mad. He was a visionary, and there was a sublime detachment about his outlook, but it was based on a secure foundation of scientific achievement.

"And it was not that he was hostile to mankind: he was sorry for it. He simply believed that humanity had shot its bolt, and wished to save something from the wreckage. I could not feel it in my heart to blame him.

"We must have been in that little hut for a long time, exploring possible futures. I remember suggesting that perhaps there might be some kind of mutual understanding, since two cultures so utterly dissimilar as Man and Termite need have no cause for conflict. But I couldn't really believe this, and if a contest comes, I'm not certain who will win. For what use would man's weapons be against an intelligent enemy who could lay waste all the wheat fields and all the rice crops in the world?

"When we came out into the open once more, it was almost dusk. It was then that the Professor made his final revelation.

"'In a few weeks,' he said, 'I am going to take the biggest step of all.'

"'And what is that? I asked.

"'Cannot you guess? I am going to give them fire.'

"Those words did something to my spine. I felt a chill that had

nothing to do with the oncoming night. The glorious sunset that was taking place beyond the palms seemed symbolic-and suddenly I realized that the symbolism was even deeper than I had thought.

"That sunset was one of the most beautiful I had ever seen, and it was partly of man's making. Up there in the stratosphere, the dust of an island that had died this day was encircling the earth. My race had taken a great step forward; but did it matter now?

"'I am going to give them fire.' Somehow, I never doubted that the Professor would succeed. And when he had done so, the forces that my own race had just unleashed would not save it . . . .

"The flying boat came to collect us the next day, and I did not see Takato again. He is still there, and I think he is the most important man in the world. While our politicians wrangle, he is making us obsolete.

"Do you think that someone ought to stop him? There may still be time. I've often thought about it, but I've never been able to think of a really convincing reason why I should interfere. Once or twice I nearly made up my mind, but then I'd pick up the newspaper and see the headlines.

"I think we should let them have the chance. I don't see how they could make a worse job of it than we've done."

The Reluctant Orchid

Arthur C. Clarke

Though few people in the "White Hart" will concede that any of Harry Purvis' stories are actually true, everyone agrees that some are much more probable than others. And on any scale of probability, the affair of the Reluctant Orchid must rate very low indeed.

I don't remember what ingenious gambit Harry used to launch this narrative: maybe some orchid fancier brought his latest monstrosity into the bar, and that set him off. No matter. I do remember the story, and after all that's what counts.

The adventure did not, this time, concern any of Harry's numerous relatives, and he avoided explaining just how he managed to know so many of the sordid details. The hero-if you can call him that-of this hothouse epic was an inoffensive little clerk named Hercules Keating. And if you think that is the most unlikely part of the story, just stick round a while.

Hercules is not the sort of name you can carry off lightly at the best of times, and when you are four foot nine and look as if you'd have to take a physical culture course before you can even become a 97-pound weakling, it is a positive embarrassment. Perhaps it helped to explain why Hercules had very little social life, and all his real friends grew in pots in a humid conservatory at the bottom of his garden. His needs were simple and he spent very little money on himself; consequently his collection of orchids and cacti was really rather remarkable. Indeed, he had a wide reputation among the fraternity of cactophiles, and often received from remote comers of the globe, parcels smelling of mould and tropical jungles.

Hercules had only one living relative, and it would have been

hard to find a greater contrast than Aunt Henrietta. She was a massive six footer, usually wore a rather loud line in Harris tweeds, drove a Jaguar with reckless skill, and chain-smoked cigars. Her parents had set their hearts on a boy, and had never been able to decide whether or not their wish had been granted. Henrietta earned a living, and quite a good one, breeding dogs of various shapes and sizes. She was seldom without a couple of her latest models, and they were not the type of portable canine which ladies like to carry in their handbags. The Keating Kennels specialized in Great Danes, Alsatians, and Saint Bernards . . . .

Henrietta, rightly despising men as the weaker sex, had never married. However, for some reason she took an avuncular (yes, that is definitely the right word) interest in Hercules, and called to see him almost every weekend. It was a curious kind of relationship: probably Henrietta found that Hercules bolstered up her feelings of superiority. If he was a good example of the male sex, then they were certainly a pretty sorry lot. Yet, if this was Henrietta's motivation, she was unconscious of it and seemed genuinely fond of her nephew. She was patronizing, but never unkind.

As might be expected, her attentions did not exactly help Hercules' own well-developed inferiority complex. At first he had tolerated his aunt; then he came to dread her regular visits, her booming voice and her bone-crushing handshake; and at last he grew to hate her. Eventually, indeed, his hate was the dominant emotion in his life, exceeding even his love for his orchids. But he was careful not to show it, realizing that if Aunt Henrietta discovered how he felt about her, she would probably break him in two and throw the pieces to her wolf pack.

There was no way, then, in which Hercules could express his pent-up feelings. He had to be polite to Aunt Henrietta even when he felt like murder. And he often did feel like murder, though he knew that there was nothing he would ever do about it. Until one day . . .

According to the dealer, the orchid came from "somewhere in the Amazon region"-a rather vague postal address. When Hercules first saw it, it was not a very prepossessing sight, even to anyone who loved orchids as much as he did. A shapeless root, about the size of a man's fist-that was all. It was redolent of decay, and there was the faintest hint of a rank, carrion smell. Hercules was not

even sure that it was viable, and told the dealer as much. Perhaps that enabled him to purchase it for a trifling sum, and he carried it home without much enthusiasm.

It showed no signs of life for the first month, but that did not worry Hercules. Then, one day, a tiny green shoot appeared and started to creep up to the light. After that, progress was rapid. Soon there was a thick, fleshy stem as big as a man's forearm, and colored a positively virulent green. Near the top of the stem a series of curious bulges circled the plant: otherwise it was completely featureless. Hercules was now quite excited: he was sure that some entirely new species had swum into his ken.

The rate of growth was now really fantastic: soon the plant was taller than Hercules, not that that was saying a great deal. Moreover, the bulges seemed to be developing, and it looked as if at any moment the orchid would burst into bloom. Hercules waited anxiously, knowing how short-lived some flowers can be, and spent as much time as he possibly could in the hothouse. Despite all his watchfulness, the transformation occurred one night while he was asleep.

In the morning, the orchid was fringed by a series of eight dangling tendrils, almost reaching to the ground. They must have developed inside the plant and emerged with-for the vegetable world-explosive speed. Hercules stared at the phenomenon in amazement, and went very thoughtfully to work.

That evening, as he watered the plant and checked its soil, he noticed a still more peculiar fact. The tendrils were thickening, and they were not completely motionless. They had a slight but unmistakable tendency to vibrate, as if possessing a life of their own. Even Hercules, for all his interest and enthusiasm, found this more than a little disturbing.

A few days later, there was no doubt about it at all. When he approached the orchid, the tendrils swayed toward him in an unpleasantly suggestive fashion. The impression of hunger was so strong that Hercules began to feel very uncomfortable indeed, and something started to nag at the back of his mind. It was quite a while before he could recall what it was: then he said to himself, "Of course! How stupid of me!" and went along to the local library. Here he spent a most interesting half-hour rereading a little piece by one H. G. Wells entitled, "The Flowering of the Strange Orchid."

"My goodness!" thought Hercules, when he had finished the tale. As yet there had been no stupefying odor which might overpower the plant's intended victim, but otherwise the characteristics were all too similar. Hercules went home in a very unsettled mood indeed.

He opened the conservatory door and stood looking along the avenue of greenery towards his prize specimen. He judged the length of the tendrils-already he found himself calling them tentacles with great care and walked to within what appeared a safe distance. The plant certainly had an impression of alertness and menace far more appropriate to the animal than the vegetable kingdom. Hercules remembered the unfortunate history of Doctor Frankenstein, and was not amused.

But, really, this was ridiculous! Such things didn't happen in real life. Well, there was one way to put matters to the test . . .

Hercules went into the house and came back a few minutes later with a broomstick, to the end of which he had attached a piece of raw meat. Feeling a considerable fool, he advanced towards the orchid as a lion-tamer might approach one of his charges at meal-time.

For a moment, nothing happened. Then two of the tendrils developed an agitated twitch. They began to sway back and forth, as if the plant was making up its mind. Abruptly, they whipped out with such speed that they practically vanished from view. They wrapped themselves round the meat, and Hercules felt a powerful tug at the end of his broomstick. Then the meat was gone: the orchid was clutching it, if one may mix metaphors slightly, to its bosom.

"Jumping Jehosophat!" yelled Hercules. It was very seldom indeed that he used such strong language.

The orchid showed no further signs of life for twenty-four hours. It was waiting for the meat to become high, and it was also developing its digestive system. By the next day, a network of what looked like short roots had covered the still visible chunk of meat. By nightfall, the meat was gone.

The plant had tasted blood.

Hercules' emotions as he watched over his prize were curiously mixed. There were times when it almost gave him nightmares, and

he foresaw a whole range of horrid possibilities. The orchid was now extremely strong, and if he got within its clutches he would be done for. But, of course, there was not the slightest danger of that. He had arranged a system of pipes so that it could be watered from a safe distance, and its less orthodox food he simply tossed within range of its tentacles. It was now eating a pound of raw meat a day, and he had an uncomfortable feeling that it could cope with much larger quantities if given the opportunity.

Hercules' natural qualms were, on the whole, outweighed by his feeling of triumph that such a botanical marvel had fallen into his hands. Whenever he chose, he could become the most famous orchid-grower in the world. It was typical of his somewhat restricted view-point that it never occurred to him that other people besides orchid-fanciers might be interested in his pet.

The creature was now about six feet tall, and apparently still growing-though much more slowly than it had been. All the other plants had been moved from its end of the conservatory, not so much because Hercules feared that it might be cannibalistic as to enable him to tend them without danger. He had stretched a rope across the central aisle so that there was no risk of his accidentally walking within range of those eight dangling arms.

It was obvious that the orchid had a highly developed nervous system, and something very nearly approaching intelligence. It knew when it was going to be fed, and exhibited unmistakable signs of pleasure. Most fantastic of all-though Hercules was still not sure about this-it seemed capable of producing sounds. There were times, just before a meal, when he fancied he could hear an

incredibly high-pitched whistle, skirting the edge of audibility. A new-born bat might have had such a voice: he wondered what purpose it served. Did the orchid somehow lure its prey into its clutches by sound? If so, he did not think the technique would work on him.

While Hercules was making these interesting discoveries, he continued to be fussed over by Aunt Henrietta and assaulted by her hounds, which were never as house-trained as she claimed them to be. She would usually roar up the street on a Sunday afternoon with one dog in the seat beside her and another occupying most of the baggage compartment. Then she would bound up the steps two at a time, nearly deafen Hercules with her greeting, half paralyze him with her handshake, and blow cigar smoke in his face. There

had been a time when he was terrified that she would kiss him, but he had long since realized that such effeminate behavior was foreign to her nature.

Aunt Henrietta looked upon Hercules' orchids with some scorn. Spending one's spare time in a hothouse was, she considered, a very effete recreation. When she wanted to let off steam, she went big-game hunting in Kenya. This did nothing to endear her to Hercules, who hated blood sports. But despite his mounting dislike for his overpowering aunt, every Sunday afternoon he dutifully prepared tea for her and they had a t8te-A-t6te together which, on the surface at least, seemed perfectly friendly. Henrietta never guessed that as he poured the tea Hercules often wished it was poisoned: she was, far down beneath her extensive fortifications, a fundamentally good-hearted person and the knowledge would have upset her deeply.

Hercules did not mention his vegetable octopus to Aunt Henrietta. He had occasionally shown her his most interesting specimens, but this was something he was keeping to himself. Perhaps, even before he had fully formulated his diabolical plan, his subconscious was already preparing the ground . . .

It was late one Sunday evening, when the roar of the Jaguar had died away into the night and Hercules was restoring his shattered nerves in the conservatory, that the idea first came fully fledged into his mind. He was staring at the orchid, noting how the tendrils were now as thick around as a man's thumb, when a most pleasing fantasy suddenly flashed before his eyes. He pictured Aunt Henrietta struggling helplessly in the grip of the monster, unable to escape from its carnivorous clutches. Why, it would be the perfect crime. The distraught nephew would arrive on the scene too late to be of assistance, and when the police answered his frantic call they would see at a glance that the whole affair was a deplorable accident. True, there would be an inquest, but the coroner's censure would be toned down in view of Hercules' obvious grief . . .

The more he thought of the idea, the more he liked it. He could see no flaws, as long as the orchid co-operated. That, clearly, would be the greatest problem. He would have to plan a course of training for the creature. It already looked sufficiently diabolical; he must give it a disposition to suit its appearance.

Considering that he had no prior experience in such matters,

and that there were no authorities he could consult, Hercules proceeded along very sound and businesslike lines. He would use a fishing rod to dangle pieces of meat just outside the orchid's range, until the creature lashed its tentacles in a frenzy. At such times its high-pitched squeak was clearly audible, and Hercules wondered how it managed to produce the sound. He also wondered what its organs of perception were, but this was yet another mystery that could not be solved without close examination. Perhaps Aunt Henrietta, if all went well, would have a brief opportunity

of discovering these interesting facts-though she would probably be too busy to report them for the benefit of posterity.

There was no doubt that the beast was quite powerful enough to deal with its intended victim. It had once wrenched a broomstick out of Hercules' grip, and although that in itself proved very little, the sickening "crack" of the wood a moment later brought a smile of satisfaction to its trainer's thin lips. He began to be much more pleasant and attentive to his aunt. In every respect, indeed, he was the model nephew.

When Hercules considered that his picador tactics had brought the orchid into the right frame of mind, he wondered if he should test it with live bait. This was a problem that worried him for some weeks, during which time he would look speculatively at every dog or cat he passed in the street, but he finally abandoned the idea, for a rather peculiar reason. He was simply too kind-hearted to put it into practice. Aunt Henrietta would have to be the first victim.

He starved the orchid for two weeks before he put his plan into action. This was as long as he dared risk-he did not wish to weaken the beast-merely to whet its appetite, that the outcome of the encounter might be more certain. And so, when he had carried the tea-cups back into the kitchen and was sitting upwind of Aunt Henrietta's cigar, he said casually: "I've got something I'd like to show you, auntie. I've been keeping it as a surprise. It'll. tickle you to death."

That, he thought, was not a completely accurate description, but it gave the general idea.

Auntie took the cigar out of her mouth and looked at Hercules

with frank surprise.

I "Well!" she boomed. "Wonders will never cease! What have

you been up to, you rascal?" She slapped him playfully on the back and shot all the air out of his lungs.

"You'll never believe it," gritted Hercules, when he had recovered his breath. "It's in the observatory."

"Eh?" said Auntie, obviously puzzled.

"Yes-come along and have a look. It's going to create a real sensation."

Auntie gave a snort that might have indicated disbelief, but followed Hercules without further question. The two Alsatians now busily chewing up the carpet looked at her anxiously and half rose to their feet, but she waved them away.

"All right, boys," she ordered gruffly. "I'll be back in a minute." Hercules thought this unlikely.

It was a dark evening, and the lights in the conservatory were off. As they entered, Auntie snorted, "Gad, Hercules-the place smells like a slaughter-house. Haven't met such a stink since I shot that elephant in Bulawayo and we couldn't find it for a week."

"Sorry, auntie," apologized Hercules, propelling her forward through the gloom. "It's a new fertilizer I'm using. It produces the most stunning results. Go on-another couple of yards. I want this to be a real surprise."

"I hope this isn't a joke," said Auntie suspiciously, as she stomped forward.

“I can promise you it’s no joke,” replied Hercules, standing with his hand on the light switch. He could just see the looming bulk of the orchid: Auntie was now within ten feet of it. He waited until she was well inside the danger zone, and threw the switch.

There was a frozen moment while the scene was transfixed with light. Then Aunt Henrietta ground to a halt and stood, arms akimbo, in front of the giant orchid. For a moment Hercules was afraid she would retreat before the plant could get into action: then he saw that she was calmly scrutinizing it, unable to make up her mind what the devil it was.

It was a full five seconds before the orchid moved. Then the dangling tentacles flashed into action-but not in the way that Hercules had expected. The plant clutched them tightly, protectively, around itself-and at the same time it gave a high-pitched scream of pure terror. In a moment of sickening disillusionment, Hercules realized the awful truth.

His orchid was an utter coward. It might be able to cope with the wild life of the Amazon jungle, but coming suddenly upon Aunt Henrietta had completely broken its nerve.

As for its proposed victim, she stood watching the creature with an astonishment which swiftly changed to another emotion. She spun around on her heels and pointed an accusing finger at her nephew.

“Hercules!” she roared. “The poor thing’s scared to death. Have you been bullying it?”

Hercules could only stand with his head hanging low in shame and frustration.

“N-no, auntie,” he quavered. “I guess it’s naturally nervous.”

“Well, I’m used to animals. You should have called me before. You must treat them firmly-but gently. Kindness always works, as long as you show them you’re the master. There, there, did-dums don’t be frightened of auntie-she won’t hurt you . . .”

It was, thought Hercules in his blank despair, a revolting sight. With surprising gentleness, Aunt Henrietta fussed over the beast, patting and stroking it until the tentacles relaxed and the shrill, whistling scream died away. After a few minutes of this pandering, it appeared to get over its fright. Hercules finally fled with a muffled sob when one of the tentacles crept forward and began to stroke Henrietta’s gnarled fingers . . .

From that day, he was a broken man. What was worse, he could never escape from the consequences of his intended crime. Henrietta had acquired a new pet, and was liable to call not only at weekends but two or three times in between as well. It was obvious that she did not trust Hercules to treat the orchid properly, and still suspected him of -bullying it. She would bring tasty tidbits that even her dogs had rejected, but which the orchid accepted with delight. The smell, which had so far been confined to the conservatory, began to creep into the house . . .

And there, concluded Harry Purvis, as he brought this improbable narrative to a close, the matter rests-to the satisfaction of two, at any rate, of the parties concerned. The orchid is happy, and Aunt Henrietta has something (query, someone?) else to dominate. From time to time the creature has a nervous breakdown when a mouse gets loose in the conservatory, and she rushes to console it.

As for Hercules, there is no chance that he will ever give any

more trouble to either of them. He seems to have sunk into a kind of vegetable sloth: indeed, said Harry thoughtfully, every day he becomes more and more like an orchid himself. The harmless variety, of course . . . .

THE SENTINEL

Arthur C. Clarke

The next time you see the full moon high in the south, look carefully at its right-hand edge and let your eye travel upward along the curve of the disk. Round about two o'clock you will notice a small, dark oval: anyone with normal eyesight can find it quite easily. It is the great walled plain, one of the finest on the Moon, known as the Mare Crisium-the Sea of Crises. Three hundred miles in diameter, and almost completely surrounded by a ring of magnificent mountains, it had never been explored until we entered it in the late summer of 1996.

Our expedition was a large one. We had two heavy freighters which had flown our supplies and equipment from the main lunar base in the Mare Serenitatis, five hundred miles away. There were also three small rockets which were intended for short-range transport over regions which our surface vehicles couldn't cross. Luckily, most of the Mare Crisiurn is very flat. There are none of the great crevasses so common and so dangerous elsewhere, and very few craters or mountains of any size. As far as we could tell, our powerful caterpillar tractors would have no difficulty in taking us wherever we wished to go.

I was geologist-or selenologist, if you want to be pedantic in charge of. the group exploring the southern region of the Mare. We had crossed a hundred miles of it in a week, skirting the foothills of the mountains along the shore of what was once the ancient sea, some thousand million years before. When life was beginning on Earth, it was already dying here. The waters were retreating down the flanks of those stupendous cliff s, retreating into the empty heart of the Moon. Over the land which we were crossing, the tideless ocean had once been half a mile deep, and now the only trace of moisture was the hoarfrost one could sometimes find in caves which the searing sunlight never penetrated.

We had begun our journey early in the slow lunar dawn, and still had almost a week of Earth-time before nightfall. Half a dozen times a day we would leave our vehicle and go outside in the spacesuits to hunt for interesting minerals, or to place markers for the guidance of future travelers. It was an uneventful routine. There is nothing hazardous or even particularly exciting about lunar exploration. We could live comfortably for a month in our pressurized tractors, and if we ran into trouble we could always radio for help and sit tight until one of the spaceships came to our rescue.

I said just now that there was nothing exciting about lunar exploration, but of course that isn't true. One could never grow tired of those incredible mountains, so much more rugged than the gentle hills of Earth. We never knew, as we rounded the capes and promontories of that vanished sea, what new splendors would be revealed to us. The whole southern curve of the Mare Crisiurn is a vast delta where a score of rivers once found their way into the ocean, fed perhaps by the torrential rains that must have lashed the mountains in the brief volcanic age when the Moon was young. Each of these ancient valleys was an invitation, challenging us to climb into the unknown uplands beyond. But we had a hundred miles still to cover, and could only look longingly at the heights which others must scale.

We kept Earth-time aboard the tractor, and precisely at 22.00 hours the final radio message would be sent out to Base and we would close down for the day. Outside, the rocks would still be burning beneath the almost vertical sun, but to us it was night until we awoke again eight hours later. Then one of us would prepare breakfast, there would be a great buzzing of electric razors, and someone would switch on the short-wave radio from Earth. Indeed, when the smell of frying sausages began to fill the cabin, it was sometimes hard to believe that we were not back on our own world - everything was so normal and homely, apart from the feeling of decreased weight and the unnatural slowness with which objects fell.

It was my turn to prepare breakfast in the corner of the main cabin that served as a galley. I can remember that moment quite vividly after all these years, for the radio had just played one of my favorite melodies, the old Welsh air, "David of the White, Rock."

Our driver was already outside in his space-suit, inspecting our caterpillar treads. My assistant, Louis Garnett, was up forward in the control position, making some belated entries in yesterday's log.

As I stood by the frying pan waiting, like any terrestrial housewife, for the sausages to brown, I let my gaze wander idly over the mountain walls which covered the whole of the southern horizon, marching out of sight to east and west below the curve of the Moon. They seemed only a mile or two from the tractor, but I knew that the nearest was twenty miles away. On the Moon, of course, there is no loss of detail with distance-none of that almost imperceptible haziness which softens and sometimes transfigures all far-off things on Earth.

Those mountains were ten thousand feet high, and they climbed steeply out of the plain as if ages ago some subterranean eruption had smashed them skyward through the molten crust. The base of even the nearest was hidden from sight by the steeply curving surface of the plain, for the Moon is a very little world, and from where I was standing the horizon was only two miles away.

I lifted my eyes toward the peaks which no man had ever climbed, the peaks which, before the coming of terrestrial life, had watched the retreating oceans sink sullenly into their graves, taking with them the hope and the morning promise of a world. The sunlight was beating against those ramparts with a glare that hurt the eyes, yet only a little way above them the stars were shining steadily in a sky blacker than a winter midnight on Earth.

I was turning away when my eye caught a metallic glitter high on the ridge of a great promontory thrusting out into the sea thirty miles to the west. It was a dimensionless point of light, as if a star had been clawed from the sky by one of those cruel peaks, and I imagined that some smooth rock surface was catching the sunlight and heliographing it straight into my eyes. Such things were not uncommon. When the Moon is in her second quarter, observers on Earth can sometimes see the great ranges in the Oceanus Procellarum burning with a blue-white iridescence as the sunlight flashes from their slopes and leaps again from world to world. But I was curious to know what kind of rock could be shining so brightly up there, and I climbed into the observation turret and swung our four inch telescope round to the west.

I could see just enough to tantalize me. Clear and sharp in the field of vision, the mountain peaks seemed only half a mile away, but whatever was catching the sunlight was still too small to be resolved. Yet it seemed to have an elusive symmetry, and the summit upon which it rested was curiously flat. I stared for a long time at that glittering enigma, straining my eyes into space, until

presently a smell of burning from the galley told me that our breakfast sausages had made their quarter-million mile journey in vain. .

All that morning we argued our way across the Mare Crisium while the western mountains reared higher in the sky. Even when we were out prospecting in the space-suits, the discussion would continue over the radio. It was absolutely certain, my companions argued, that there had never been any form of intelligent life on the Moon. The only living things that had ever existed there were a few primitive plants and their slightly less degenerate ancestors. I knew that as well as anyone, but there are times when a scientist must not be afraid to make a fool of himself.

"Listen," I said at last, "I'm going up there, if only for my own peace of mind. That mountain's less than twelve thousand feet high -that's only two thousand under Earth gravity-and I can make the trip in twenty hours at the outside. I've always wanted to go up into those hills, anyway, and this gives me an excellent excuse."

"If you don't break your neck," said Garnett, "you'll be the laughing-stock of the expedition when we get back to Base. That mountain will probably be called Wilson's Folly from now on."

"I won't break my neck," I said firmly. "Who was the first man to climb Pico and Helicon?"

"But weren't you rather younger in those days?" asked Louis gently.

"That," I said with great dignity, "is as good a reason as any for going."

We went to bed early that night, after driving the tractor to within half a mile of the promontory. Garnett was coming with me in the morning; he was a good climber, and had often been with me on such exploits before. Our driver was only too glad to be left in charge of the machine.

At first sight, those cliffs seemed completely unscalable, but to anyone with a good head for heights, climbing is easy on a world where all weights are only a sixth of their normal value. The real danger in lunar mountaineering lies in overconfidence; a six-hundred-foot drop on the Moon can kill you just as thoroughly as a. hundred-foot fall on Earth.

We made our first halt on a wide ledge about four thousand feet above the plain. Climbing had not been very difficult, but my limbs were stiff with the unaccustomed effort, and I was glad of the rest. We could still see the tractor as a tiny metal insect far down at the foot of the cliff, and we reported our progress to the driver before starting on the next ascent.

Inside our suits it was comfortably cool, for the refrigeration units were fighting the fierce sun and carrying away the body-heat of our exertions. We seldom spoke to each other, except to pass climbing instructions and to discuss our best plan of ascent. I do not know what Garnett was thinking, probably that this was the craziest goose-chase he had ever embarked upon. I more than half agreed with him, but the joy of climbing, the knowledge that no man had ever gone this way before and the exhilaration of the steadily widening landscape gave me all the reward I needed.

I don't think I was particularly excited when I saw in front of us the wall of rock I had first inspected through the telescope from thirty miles away. It would level off about fifty feet above our heads, and there on the plateau would be the thing that had lured me over these barren wastes. It was, almost certainly, nothing more than a boulder splintered ages ago by a falling meteor, and with its cleavage planes still fresh and bright in this incorruptible, unchanging silence.

There were no hand-holds on the rock face, and we had to use a grapnel. My tired arms seemed to gain new strength as I swung the three-pronged metal anchor round my head and sent it sailing Lip

toward the stars. The first time it broke loose and came falling slowly back when we pulled the rope. On the third attempt, the prongs gripped firmly and our combined weights could not shift it.

Garnett looked at me anxiously. I could tell that he wanted to go first, but I smiled back at him through the glass of my helmet and shook my head. Slowly, taking my time, I began the final ascent.

Even with my space-suit, I weighed only forty pounds here, so I pulled myself up hand over hand without bothering to use my feet. At the rim I paused and waved to my companion, then I scrambled over the edge and stood upright, staring ahead of me.

You must understand that until this very moment I had been almost completely convinced that there could be nothing strange or unusual for me to find here. Almost, but not quite; it was that haunting doubt that had driven me forward. Well, it was a doubt no longer, but the haunting had scarcely begun.

I was standing on a plateau perhaps a hundred feet across. It had once been smooth-too smooth to be natural-but falling meteors had pitted and scored its surface through immeasurable eons. It had been leveled to support a glittering, roughly pyramidal structure, twice as high as a man, that was set in the rock like a gigantic, many-faceted jewel.

Probably no emotion at all filled my mind in those first few seconds. Then I felt a great lifting of my heart, and a strange, inexpressible joy. For I loved the Moon, and now I knew that the creeping moss of Aristarchus and Eratosthenes was not the only life she had brought forth in her youth. The old, discredited dream of the first explorers was true. There had, after all, been a lunar civilization-and I was the first to find it. That I had come perhaps a hundred million years too late did not distress me; it was enough to have come at all.

My mind was beginning to function normally, to analyze and to ask questions. Was this a building, a shrine-or something for which my language had no name? If a building, then why was it erected in so uniquely inaccessible a spot? I wondered if it might be a temple, and I could picture the adepts of some strange priesthood calling on their gods to preserve them as the life of the Moon ebbed with the dying oceans, and calling on their gods in vain.

I took a dozen steps forward to examine the thing more closely, but some sense of caution kept me from going too near. I knew a little of archaeology, and tried to guess the cultural level of the civilization that must have smoothed this mountain and raised the glittering mirror surfaces that still dazzled my eyes.

The Egyptians could have done it, I thought, if their workmen had possessed whatever strange materials these far more ancient architects had used. Because of the thing's smallness, it did not occur to me that I might be looking at the handiwork of a race more advanced than my own. The idea that the Moon had possessed intelligence at all was still almost too tremendous to grasp, and my pride would not let me take the final, humiliating plunge.

And then I noticed something that set the scalp crawling at the back of my neck-something so trivial and so innocent that many would never have noticed it at all. I have said that the plateau was scarred by meteors; it was also coated inches-deep with the cosmic dust that is always filtering down upon the surface of any world where there are no winds to disturb it. Yet the dust and the meteor scratches ended quite abruptly in a wide circle enclosing the little pyramid, as though an invisible wall was protecting it from the ravages of time and the slow but ceaseless bombardment from space.

There was someone shouting in my earphones, and I realized that Garnett had been calling me for some time. I walked unsteadily to the edge of the cliff and signaled him to join me, not trusting myself to speak. Then I went back toward that circle in the dust. I picked up a fragment of splintered rock and tossed it gently toward the shining enigma. If the pebble had vanished at that invisible barrier I should not have been surprised, but it seemed to hit a smooth, hemispherical surface and slide gently to the ground.

I knew then that I was looking at nothing that could be matched in the antiquity of my own race. This was not a building, but a machine, protecting itself with forces that had challenged Eternity. Those forces, whatever they might be, were still operating, and perhaps I had already come too close. I thought of all the radiations man had trapped and tamed in the past century. For all I knew, I might be as irrevocably doomed as if I had stepped into the deadly, silent aura of an unshielded atomic pile.

I remember turning then toward Garnett, who bad joined me and was now standing motionless at my side. He seemed quite oblivious to me, so I did not disturb him but walked to the edge of the cliff in an effort to marshal my thoughts. There below me lay the Mare Crisium-Sea of Crises, indeed-strange and weird to most men, but reassuringly familiar to me. I lifted my eyes toward the crescent Earth, lying in her cradle of stars, and I wondered what her clouds had covered when these unknown builders had finished their work. Was it the steaming jungle of the Carboniferous, the bleak shoreline over which the first amphibians must crawl to conquer the land-or, earlier still, the long loneliness before the coming of life?

Do not ask me why I did not guess the truth sooner-the truth, that seems so obvious now. In the first excitement of my discovery, I had assumed without question that this crystalline apparition had been built by some race belonging to the Moon's remote past, but suddenly, and with overwhelming force, the belief came to me that it was as alien to the Moon as I myself.

In twenty years we had found no trace of life but a few degenerate plants. No lunar civilization, whatever its doom, could have left but a single token of its existence.

I looked at the shining pyramid again, and the more remote it seemed from anything that had to do with the Moon. And suddenly I felt myself shaking with a foolish, hysterical laughter, brought on by excitement and overexertion: for I had imagined that the little pyramid was speaking to me and was saying: "Sorry, I'm a stranger here myself."

It has taken us twenty years to crack that invisible shield and to reach the machine inside those crystal walls. What we could not understand, we broke at last with the savage might of atomic power and now I have seen the fragments of the lovely, glittering thing I found up there on the mountain.

They are meaningless. The mechanisms-if indeed they are mechanisms-of the pyramid belong to a technology that lies far beyond our horizon, perhaps to the technology of para-physical forces.

The mystery haunts us all the more now that the other planets have been reached and we know that only Earth has ever been the home of intelligent life in our Universe. Nor could any lost civilization of our own world have built that machine, for the thickness of the meteoric dust on the plateau has enabled us to measure its age. It was set there upon its mountain before life had emerged from the seas of Earth.

When our world was half its present age, something from the stars swept through the Solar System, left this token of its passage, and went again upon its way. Until we destroyed it, that machine was still fulfilling the purpose of its builders; and as to that purpose, here is my guess.

Nearly a hundred thousand million stars are turning in the circle of the Milky Way, and long ago other races on the worlds of other suns must have scaled and passed the heights that we have reached. Think of such civilizations, far back in time against the fading afterglow of Creation, masters of a universe so young that life as yet had come only to a handful of worlds. Theirs would have been a loneliness we cannot imagine, the loneliness of gods looking out across infinity and finding none to share their thoughts.

They must have searched the star-clusters as we have searched the planets. Everywhere there would be worlds, but they would be empty or peopled with crawling, mindless things. Such was our own Earth, the smoke of the great volcanoes still staining the skies, when that first ship of the peoples of the dawn came sliding in from the abyss beyond Pluto. It passed the frozen outer worlds, knowing that life could play no part in their destinies. It came to rest among the inner planets, warming themselves around the fire of the Sun and waiting for their stories to begin.

Those wanderers must have looked on Earth, circling safely in the narrow zone between fire and ice, and must have guessed that it was the favorite of the Sun's children. Here, in the distant future, would be intelligence; but there were countless stars before -them still, and they might never come this way again.

So they left a sentinel, one of millions they have scattered throughout the Universe, watching over all worlds with the promise of life. It was a beacon that down the ages has been patiently signaling the fact that no one had discovered it.

Perhaps you understand now why that crystal pyramid was set upon the Moon instead of on the Earth. Its builders were not concerned with races still struggling up from savagery. They would be interested in our civilization only if we proved our fitness to survive -by crossing space and so escaping from the Earth, our cradle. That is the challenge that all intelligent races must meet, sooner or later. It is a double challenge, for it depends in turn upon the conquest of atomic energy and the last choice between life and death.

Once we had passed that crisis, it was only a matter of time before we found the pyramid and forced it open. Now its signals have ceased, and those whose duty it is will be turning their minds upon Earth. Perhaps they wish to help our infant civilization. But they must be very, very old, and the old are often insanely jealous of the young.

I can never look now at the Milky Way without wondering from which of those banked clouds of stars the emissaries are coming. If you will pardon so commonplace a simile, we have set off the fire-alarm and have nothing to do but to wait.

I do not think we will have to wait for long.

The Star

by

Arthur C. Clarke

It is three thousand light-years to the Vatican. Once I believed that space could have no power over faith. Just as I believed that the heavens declared the glory of God's handiwork. Now I have seen that handiwork, and my faith is sorely troubled.

I stare at the crucifix that hangs on the cabin wall above the Mark VI computer, and for the first time in my life I wonder if it is no more than an empty symbol. I have told no one yet, but the truth cannot be concealed. The data are there for anyone to read, recorded on the countless miles of magnetic tape and the thousands of photographs we are carrying back to Earth. Other scientists can interpret them as easily as I can--more easily, in all probability. I am not one who would condone that tampering with the truth which often gave my order a bad name in the olden days.

The crew is already sufficiently depressed, I wonder how they will take this ultimate irony. Few of them have any religious faith, yet they will not relish using this final weapon in their campaign against me--that private, good-natured but fundamentally serious war which lasted all the way from Earth. It amused them to have a Jesuit as chief astrophysicist. Dr. Chandler, for instance, could never get over it (why are medical men such notorious atheists?). Sometimes he would meet me on the observation deck, where the lights are always low, so that the stars shine with undiminished glory. He would come up to me in the gloom and stand staring out of the great oval port, while the heavens crawled slowly round us as the ship turned end over end with the residual spin we had never bothered to correct.

"Well, Father," he would say at last. "It goes on forever and forever, and perhaps Something made it. But how you can believe that Something has a special interest in us and our miserable little world--that just beats me." Then the argument would start, while the stars and nebulae would swing around us in silent, endless arcs beyond the flawlessly clear plastic of the observation port. It was, I think, the apparent incongruity of my position which, yes, amused the crew. In vain I would point to my three papers in the Astrophysical Journal, my five in the Monthly Notices of the Royal Astronomical Society. I would remind them that our order has long been famous for its scientific works. We may be few now, but ever since the eighteenth century we have made contributions to astronomy and geophysics out of all proportion to our numbers.

Will my report on the Phoenix Nebula end our thousand years of history? It will end, I fear, much more than that. I do not know who gave the nebula its name, which seems to me a very bad one. If it contains a prophecy, it is one which cannot be verified for several thousand million years. Even the word "nebula" is misleading; this is a far smaller object than those stupendous clouds of mist--the stuff of unborn stars--which are scattered throughout the length of the Milky Way. On the cosmic scale, indeed, the Phoenix Nebula is a tiny thing--a tenuous shell of gas surrounding a single star. Or what is left of a star . . .

The Rubens engraving of Loyola seems to mock me as it hangs there above the spectrophotometer tracings. What would you, Father, have made of this knowledge that has come into my keeping, so far from the little world that was all the universe you knew? Would your faith have risen to the challenge, as mine has failed to do? You gaze into the distance, Father, but I have traveled a distance beyond any that you could have imagined when you founded our order a thousand years ago. No other survey ship has been so far from Earth: we are at the very frontiers of the explored universe. We set out to reach the Phoenix Nebula, we succeeded, and we are homeward bound with our burden of knowledge. I wish I could lift that burden from my shoulders, but I call to you in vain

across the centuries and the light-years that lie between us. On the book you are holding the words are plain to read. "AD MAIOREM DEI GLORIAM," the message runs, but it is a message I can no longer believe. Would you still believe it if you could see what we have found?

We knew, of course, what the Phoenix Nebula was. Every year, in our galaxy alone, more than a hundred stars explode, blazing for a few hours or days with thousands of times their normal brilliance before they sink back into death and obscurity. Such are the ordinary novae--the commonplace disasters of the universe. I have rocorded the spectrograms and light curves of dozens, since I started working at the lunar observatory. But three or four times in every thousand years occurs something beside which even a nova pales into total insignificance.

When a star becomes a supernova, it may for a little while outshine all the massed suns of the galaxy. The Chinese astronomers watched this happen in A.D. 1054, not knowing what it was they saw. Five centuries later, in 1572, a supernova blazed in Cassiopeia so brilliantly that it was visible in the daylight sky. There have been three more in the thousand years that have passed since then. Our mission was to visit the remnants of such a catastrophe, to reconstruct the events that led up to it, and, if possible, to learn its cause. We came slowly in through the concentric shells of gas that had been blasted out six thousand years before, yet were expanding still. They were immensely hot, radiating still with a fierce violet light, but far too tenuous to do us any damage. When the star had exploded, its outer layers had been driven upward with such speed that they had escaped completely from its gravitational field. Now they formed a hollow shell large enough to engulf a thousand solar systems, and at its center burned the tiny, fantastic object which the star had now become--a white dwarf, smaller than the Earth, yet weighing a million times as much. The glowing gas shells were all around us, banishing the normal night of interstellar space. We were flying into the center of a cosmic bomb that had detonated millennia ago and whose incandescent fragments were still hurtling apart. The immense scale of the explosion, and the fact that the debris already covered a volume of space many billions of miles across, robbed the scene of any visible movement. It would take decades before the unaided eye could detect any motion in these tortured wisps and eddies of gas, yet the sense of turbulent expansion was overwhelming. We had checked our primary drive hours before and were drifting slowly toward the fierce little star ahead. Once it had been a sun like our own, but it had squandered in a few hours the energy that should have kept it shining for a million years. Now it was a shrunken miser, hoarding its resources as if trying to make amends for its prodigal youth.

No one seriously expected to find planets. If there had been any before the explosion, they would have been boiled into puffs of vapor and their substance lost in the greater wreckage of the star itself. But we made the automatic search, as always when approaching an unknown sun, and presently we found a single small world circling the star at an immense distance. It must have been the Pluto of this vanished solar system, orbiting on the frontiers of the night. Too far from the central sun ever to have known life, its remoteness had saved it from the fate of all its lost com- panions.

The passing fires had seared its rocks and burned away the mantle of frozen gas that must have covered it in the days before the disaster. We landed, and we found the Vault.

Its builders had made sure that we should. The monolithic marker that stood above the entrance was now a fused stump, but even the first long-range photographs told us that here was the work of intelligence. A little later we detected the continent-wide pattern of radioactivity that had been buried in the rock. Even if the pylon above the Vault had been destroyed, this would have remained, an immovable and all but eternal beacon calling to the stars. Our ship fell toward this gigantic bull's-eye like an arrow into its target.

The pylon must have been a mile high when it was built, but now it looked like a candle that had melted down into a puddle of wax. It took us a week to drill through the fused rock, since we did not have the proper tools for a task like this. We were astronomers, not archaeologists, but we could improvise. Our original program was forgotten: this lonely monument, reared at such labor at the greatest possible distance from the doomed sun, could have only one meaning. A civilization which knew it was about to die had made its last bid for immortality.

It will take us generations to examine all the treasures that were placed in the Vault. They had plenty of time to prepare, for their sun must have given its first warnings many years before the final detonation. Everything that they wished to preserve, all the fruits of their genius, they brought here to this distant world in the days before the end, hoping that some other race would find them and that they would not be utterly forgotten.

If only they had a little more time! They could travel freely enough between the planets of their own sun, but they had not yet learned to cross the interstellar gulfs, and the nearest solar system was a hundred light-years away. Even if they had not been so disturbingly human as their sculpture shows, we could not have helped admiring them and grieving for their fate. They left thousands of visual records and the machines for projecting them, together with elaborate pictorial instructions from which it will not be difficult to learn their written language. We have examined many of these records, and brought to life for the first time in six thousand years the warmth and beauty of a civilization which in many ways must have been superior to our own. Perhaps they only showed us the best, and one can hardly blame them. But their worlds were very lovely, and their cities were built with a grace that matches anything of ours. We have watched them at work and play, and listened to their musical speech sounding across the centuries. One scene is still before my eyes--a group of children on a beach of strange blue sand, playing in the waves as children play on Earth.

And sinking into the sea, still warm and friendly and life-giving, is the sun that will soon turn traitor and obliterate all this innocent happiness.

Perhaps if we had not been so far from home and so vulnerable to loneliness, we should not have been so deeply moved. Many of us had seen the ruins of ancient civilizations on other worlds, but they had never affected us so profoundly.

This tragedy was unique. It was one thing for a race to fail and die, as nations and cultures have done on Earth. But to be destroyed so completely in the full flower of its achievement, leaving no survivors--how could that be reconciled with the mercy of God?

My colleagues have asked me that, and I have given what answers I can. Perhaps you could have done better, Father Loyola, but I have found nothing in the Exercitia spiritualia that helps me here. They were not an evil people: I do not know what gods they worshiped, if indeed they worshiped any. But I have looked back at them across the centuries, and have watched while the loveliness they used their last strength to preserve was brought forth again into the light of their shrunken sun.

I know the answers that my colleagues will give when they get back to Earth. They will say that the universe has no purpose and no plan, that since a hundred suns explode every year in our galaxy, at this very moment some race is dying in the depths of space. Whether that race has done good or evil during its lifetime will make no difference in the end: there is no divine justice, for there is no God. Yet, of course, what we have seen proves nothing of the sort. Anyone who argues thus is being swayed by emotion, not logic. God has no need to justify His actions to man. He who built the universe can destroy it when He chooses. It is arrogance--it is perilously near blasphemy for us to say what He may or may not do.

This I could have accepted, hard though it is to look upon whole worlds and peoples thrown into the furnace. But there comes a point when even the deepest faith must falter, and now, as I look at my calculations, I know I have reached that point at last.

We could not tell, before we reached the nebula, how long ago the explosion took place. Now, from the astronomical evidence and the record in the rocks of that one surviving planet, I have been able to date it very exactly. I know in what year the light of this colossal conflagration reached Earth. I know how brilliantly the supernova whose corpse now dwindles behind our speeding ship once shone in terrestrial skies. I know how it must have blazed low in the East before sunrise, like a beacon in that Oriental dawn. There can be no reasonable doubt: the ancient mystery is solved at last. Yet O God, there were so many stars you could have used.

What was the need to give these people to the fire, that the symbol of their passing might shine above Bethlehem?

Transience

By: Arthur C. Clarke

The forest, which came almost to the edge of the beach, climbed away into the distance up the flanks of the low, misty hills. Underfoot, the sand was course and mixed with myriads of broken shells. Here and there the retreating tide had left long streamers of weed trailed across the beach. The rain, which seldom ceased, had for the moment passed inland, but ever and again large, angry drops would beat tiny craters into the sand. It was hot and sultry, for the war between sun and rain was never-ending. Sometimes the mists would lift for a while and the hills would stand out clearly above the land they guarded. The hills arced in a semicircle along the bay, following the line of the beach, and beyond them could sometimes be seen, at an immense distance, a wall of mountains lying beneath perpetual clouds. The trees grew everywhere, softening the contours of the land so that the hills blended smoothly into each other. Only in one place could the bare, uncovered rock be seen, where long ago some fault had weakened the foundations of the hills, so that for a mile or more the sky line fell sharply away, drooping down to the sea like a broken wing. Moving with the cautious alertness of a wild animal, the child came through the stunted trees at the forest's edge. For a moment he hesitated; then, since there seemed to be no danger, walked slowly out onto the beach. He was naked, heavily built, and had course black hair tangled over his shoulders. His face, brutish though it was, might almost have passed in human society, but the eyes would have betrayed him. They were not the eyes of an animal, for there was something in their depths that no animal had ever known. But it was no more than a promise. For this child, as for all his race, the light of reason had yet to dawn. Only a hairsbreadth still separated him from the beasts among whom he dwelt. The tribe had not long since come into this tribe, and he was the first ever to set foot upon the lonely beach. What had lured him from the known dangers of the forest into the unknown and therefore more terrible dangers of this new element. he could not have told even had he possessed the power of speech. Slowly he walked out to the water's edge, always with backward glances at the forest behind him; as he did so, for the first time in all history, the level sand bore upon its face the footprints it would one day know so well. He had met water before, but it had always been bounded and confined by land. Now it stretched endlessly before him, and the sound of its labouring beat ceaselessly upon his ears.

With the timeless patience of the savage, he stood on the moist sand that the water had just relinquished, and as the tide line moved out he followed it slowly, pace by pace. When the waves reached towards his feet with a sudden access of energy, he would retreat a little way toward the land. But something held him here at the water's edge, while his shadow lengthened along the sands and the cold evening wind began to rise around him. Perhaps into his mind had come something of the wonder of the sea, and a hint of all that it would one day mean to man. Though the first gods of his people stay lay far into the future, he felt a dim sense of worship stir within him. He knew that he was now in the presence of something greater than all the powers and forces he had ever met. The tide was turning. Far away in the forest, a wolf howled once and was suddenly silent. The noises of the night were rising around him, and it was time to go.

Under the low moon, the two lines of footprints interlaced across the sand. Swiftly the oncoming tide was smoothing them away. But they would return in their thousands and millions, in the centuries yet to be. The child playing among the rock pools knew nothing of the forest that had once ruled all of the land around him. It had left no trace of its existence. As ephemeral as the mists that had so often rolled down from the hills, it too, had veiled them for a little while and now was gone. In its place had come a checkerboard of fields, the legacy of a thousand years of patient toil. And so the illusion of permanence remained, though everything had altered save the line of the hills against the sky. On the beach, the sand was finer now, and the land had lifted so that the old tide line was far beyond the reach of the questing waves. Beyond the sea wall and the promenade, the little town was sleeping through the golden summer day. Here and there along the beach, people lay at rest, drowsy with heat and lulled by the murmur of the waves. Out across the bay, white and gold against the water, a great ship was moving slowly to sea. The boy could hear, faint and far away, the beat of its screws and could still see the tiny figures moving upon its decks and superstructure. To the child - and not to him alone - it was a thing of wonder and beauty. He knew its name and the land to which it was steaming; but he did not know that the splendid ship was both the last and greatest of its kind. He scarcely noticed, almost lost against the glare of the sun, the thin white vapour trails that spelled the doom of the proud and lonely giant.

Soon the great liner was no more than a dark smudge on the horizon, and the boy turned again to his interrupted play, to the tireless building of his battlements of sand. In the west the sun was beginning its long decline, but the evening was still far away.

Yet it came at last, when the tide was returning to the land. At his mother's words, the child gathered up his playthings and, wearily contented, began to follow his parents back to the shore. He glanced once only at the sea again. Without regret he left them to the advancing waves, for tomorrow he would return and the future stretched endlessly before him. That tomorrow would not always come, either for himself or for the world, he was still too young to know.

And now even the hills had changed, worn away by the weight of years. Not all the change was the work of nature, for one night in the long forgotten past something had come sliding down from the stars, and the little town had vanished in a spinning tower of flame. But that was so long ago that it was beyond sorrow or regret. Like the fall of fabled Troy or the overwhelming of Pompeii, it was part of the irremediable past, and could rouse no pity now. On the broken sky line lay a long metal building supporting a maze of mirrors that turned and glittered in the sun. No-one from an earlier age could have guessed its purpose. It was as meaningless as an observatory or a radio station would have been to ancient man. But it was neither of these things.

Since noon, Bran had been laying among the shallow pools left by the retreating tide. He was quite alone, though the machine that guarded him was watching unobtrusively from the shore. Only a few days ago, there had been other children playing beside the blue waters of this lovely bay. Bran sometimes wondered where they had vanished, but he was a solitary child and did not greatly care. Lost in his own dreams, he was content to be left alone.

In the last few hours he had linked the tiny pools with an intricate network of waterways. His thoughts were very far from Earth, both in space and time. Around him now were the dull, red sands of another world. He was Cardenis, prince of engineers, fighting to save his people from the encroaching deserts. For Bran had looked upon the ravaged face of Mars; he knew the story of its long tragedy and the help from Earth that had come too late. Out to the horizon the sea was empty, untroubled by ships, as it had been for ages. For a little while, near the beginning of time, man had

fought his brief war against the oceans of the world. Now it seemed that only a moment lay between the coming of the first canoes and the passing of the last great Megatheria of the seas.

Bran did not even glance up at the sky when the monstrous shadow swept along the beach. For days past, those silver giants had been rising over the hills in an unending stream, and now he gave them little thought. All his life he had watched the great ships climbing through the skies of Earth on their way to distant worlds. Often he had seen them return from those long journeys, dropping down through the clouds with cargoes beyond imagination. He wondered sometimes why they came no more, those returning voyagers. All the ships he saw now were outward bound; never one drove down from the skies to berth at the great port beyond the hills. Why this should be, no one would tell him. He had learned not to speak of it now, having seen the sadness that his questions brought.

Across the sands the robot was calling to him softly. "Bran," came the words, echoing the tones of his mother's voice,"Bran - its time to go". The child looked up, his face full of indignant denial. He could not believe it. The sun was still high and the tide was far away. Yet along the shore his mother and father were already coming toward him. They walked swiftly, as though the time was short. Now and again his father would glance for an instant at the sky, then turn his head quickly away as if he knew well that there was nothing he could hope to see. But a moment later he would look up again.

Stubborn and angry, Bran stood among his canals and lakes. His mother was strangely silent, but presently his father took him by the hand and said quietly, you must come with us Bran. Its time we went. The child pointed sullenly at the beach. "But its too early. I haven't finished". His father's reply had no trace of anger, only a great sadness. There are many things Bran, that will not be finished now. Still uncomprehending, the boy turned to his mother. "Then can I come again tomorrow"? With a sense of desolating wonder, Bran saw his mother's eyes fill with sudden tears. And he knew at last that never again would he play upon the sands by the azure waters; never again would he feel the tug of the tiny waves about his feet. He had found the sea too late, and now must leave it forever. Out of the future, chilling his soul, came the first intimation of the long ages of exile that lay ahead.

He never looked back as they walked silently together across the clinging sand. This moment would be with him all his life, but he was too stunned to do more than walk blindly into a future he could not understand. The three figures dwindled into the distance and were gone. A while later, a silver cloud seemed to lift above the hills and move slowly out to sea. In a shallow arc, as though reluctant to leave its world, the last of the great ships climbed towards the horizon and shrank to nothingness over the edge of the Earth.

The tide was returning with the dying day. As though its makers still walked within its walls, the low metal building upon the hills had begun to blaze with light. Near the zenith, one star had not waited for the sun to set, but already burned with a fierce white glare against the darkening sky. Soon its companions, no longer in the scant thousands that mankind had once known, began to fill the heavens. The Earth was now near the centre of the universe, and whole areas of the sky were an unbroken blaze of light. But rising beyond the sea in two long curving arms, something black and monstrous eclipsed the stars and seemed to cast its shadow over all the world. The tentacles of the Dark Nebula were already brushing against the frontiers of the solar system....

In the east, a great yellow moon was climbing through the waves. Though mankind had torn down its mountains and brought it air and water, its face was the one that had looked upon Earth since its

history began, and it was still the ruler of the tides. Across the sand the line of foam moved steadily onwards, overwhelming the little canals and planing down the mangled footprints.

On the sky line, the lights in the strange metal building suddenly died, and the spinning mirrors ceased their moonlight glittering. From far inland came the blinding flash of a great explosion, then another, and another fainter yet.

Presently the ground trembled a little, but no sound disturbed the solitude of the deserted shore. Under the level light of the sagging moon, beneath the myriad stars, the beach lay waiting for the end. It was alone now, as it had been at the beginning. Only the waves would move, and but for a little while, upon its golden sands.

For mankind had come and gone.

THE END