Timeshift

A novel by

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1
Rum-Lem

Rum-Lem's fingers flew as he entered a new command sequence. The Kivran ships were closing quickly. He glanced up at the opnav screen floating before him as he finished entering the maneuvers into the databox. A fourth ship had come into range while he had been working. Like the other three it was a long way behind, but this one was closing even faster than the others.

He commanded the opnav databox: "Check path."

There was a barely perceptible pause before the databox responded: "Jump sequence exceeds safety parameters."

On the opnav screen appeared the codes corresponding to the maneuvers he had entered: CLOAK; REVECTOR BY (15, 95, 3); EXECUTE HYPERSPACE JUMP OF 125·3 DERNS. The revector and the hyperjump were flashing red: the stresses on the ship during the revector exceeded the design limits, and the probability of ending the hyperspace jump too close to a normal-space object was too high.

He frowned and watched the progress of the ships for half a decichron. That fourth ship sure was moving; it had already overtaken one of the others. There was no time to let the opnav system calculate a safe sequence. Even as he reached this conclusion, the blip marking the fourth ship changed color and the weapons system emitted a distinctive buzz.

"Enemy ship within weapons range in five hundred millichrons."

He tried to stay calm.

"Opnav override and execute."

The opnav system flashed: Sequence Executing.

The light indicating full cloaking came on, followed instantly by a revectoring that exceeded the limits of the onboard gravity-canceling mechanism. Every object inside the ship, Rum-Lem included, suddenly gained inertia and was thrown sharply upwards and to the left.

Rum-Lem grimaced. He fought to remain conscious as the thrusters whipped the ship around. He could feel the fabric of the restraint belt biting painfully into his shoulder. It was difficult to see properly: his eyes felt like they were being pulled from their sockets. He closed them. The inside of the lids turned red. He could feel the heavy pressure of blood inside his head. His skull felt like it was about to explode. He knew from experience what would come next: he was about to lose consciousness.

At the last possible moment, the forces released him from their grip as the revector ended and gravity inside the ship returned to normal. Almost simultaneously, he felt the juddery tingle in his stomach that indicated a spacetime bubble forming around the ship. A fraction later, a beep sounded: the hyperjump was starting.

He opened his eyes and shook his head to clear it. A tenth of a chron passed before he could see properly, by which time the ship had completed the jump. The opnav screen burst into life as the spacetime bubble collapsed, relocating the ship on the spacetime manifold. He glanced at the damage assessment indicator. It was blank, which meant that either the assessment monitors themselves were damaged or that the ship had passed through the violent maneuver unscathed. He assumed the latter, and relaxed. There was no way he could have been followed through that jump. He had escaped.

Rum-Lem let out a long sigh of relief.

"Opnav, where am I?"

It was a simple question, but one that might take several hundred millichrons for the opnav databox to answer after a jump of that magnitude.

He waited, watching the screens.

Everything appeared normal. There were no other ships within scanner range. Nor were there any substantial sources of spacetime curvature. That meant that he had to be some way from the center of the galaxy, out where the distance between stars was measured in hundreds of milliderns.

"Location calculated," the databox announced, and simultaneously a pair of holographic images appeared in front of him.

Rum-Lem exclaimed in surprise. He was very close to the demilitarized zone. He would have to be careful: there might be imperial patrols out here. But he wouldn't be here long: what he had learned was too important, too unbelievable. He had to get back home and deliver his message without delay. He *had* to.

A flicker of light caught the corner of his eye.

The opnav databox alerted him: "Ship entered scanning range."

The ship identified itself, and for a moment, Rum-Lem could not believe it. One of the ships that had been chasing him before the hyperjump had followed him through it. But that was not possible. No one could have followed him through that jump. Reflexively, he looked up at the cloaking indicator. It was lit.

"Systems databox, independent check: am I cloaked?"

"Affirmative."

A second light flashed on the screen, then a third, and a fourth. Three of the four ships IDed. They matched the ID numbers of the slower three ships that had been chasing him before the jump. The remaining blip was moving faster than the others, and it had failed, illegally, to respond to ID interrogation. As he watched, the anonymous ship passed another of the pursuing vessels. Simultaneously, the weapons databox repeated its warning: "Enemy ship within weapons range in five hundred millichrons."

Rum-Lem looked at the mass of information hanging in front of him. For a moment his mind went blank. He had been followed through an unplanned revectored hyperspace jump while cloaked. Everything he knew told him that was impossible. Yet it had happened, and if he didn't think of something quickly, he was about to pay for his mistake with his life.

He wondered momentarily if he should simply surrender. Once he did that, the Kivrans were legally obligated not to end his life. But a moment's reflection convinced him of the stupidity of that idea. If they had been near the galactic center it might — just — have worked. His surrender broadcast would almost certainly have been picked up and recorded, and the Kivrans chasing him would know that. But out here he could broadcast as much as he liked and the chance of an intercept was negligible.

No, if he surrendered, the legalities would be ignored and he would be killed — or worse — without a qualm. He had no option: he simply had to escape or die in the attempt.

He turned away from the opnav screen even as it showed the unidentified ship passing the last of the other ships. It was still closing. He wondered what kind of ship it was, and who was piloting it. The pilot certainly knew his stuff.

Then he saw the photon missile.

He understood immediately that the unknown pilot knew that the missile would never reach its target; its purpose was not to kill, but to harry. The pilot was even better than Rum-Lem had thought.

"Emergency! New jump sequence. Random revector, jump 500 derns. Full manual override."

The word Manual flashed in the air before him. The databox began to speak the word. Rum-Lem's hand pressed the button marked Manual Sequence Execute before the databox had completed the first syllable.

The restraining belt bit into his flesh. He closed his eyes, tried to suck in a breath, found it impossible, and simply began to count slowly while his head swam and the inside of his eyelids grew darker and redder. He felt as if the life was being crushed out of him.

He remembered his boast in the simulator: no one could survive accelerative forces as well as he. The boast became a taunt, echoing inside his head. He felt consciousness beginning to slip away.

The force released him and an alarm began to ring, filling the cabin with urgent noise.

"Warning! Warning! Current course will lead to destruction. Automatic override not possible. Spacetime curvature exceeds safety parameters."

Rum-Lem opened his eyes and tried desperately to focus. Everything was a blur, but even through the fog he knew that something was desperately wrong. The holoimage that showed the view in front of the ship was no longer its customary black. Instead it was a glaring yellow.

He barked: "Opnav. Automatic control."

For a moment he relaxed. Whatever the problem was, the opnav databox would take care of it now.

But the databox repeated: "Warning! Warning! Current course will lead to destruction. Automatic override not possible. Spacetime curvature exceeds safety parameters."

Rum-Lem rubbed his eyes and blinked. At last he could focus on the screens before him. The damage assessment screen was flashing in bright red: Opnav control inoperable. Of the million-and-one systems that could have failed, he had lost the one he needed most.

He looked at the forward view. Even after the automatic brightness corrections, the yellow was blisteringly bright. But it was not featureless. It had a rice-grain pattern, dark runnels separating bright, elongated patches. He knew what that meant: he was looking at a star, very close, and the ship was heading straight for it.

"Opnav, full manual navigation display and control."

He grabbed the manual flight controls as the screens disappeared. In their place all around him suddenly hung a series of views of the spacecraft and its surroundings. Until now, he had been relying on machines, now it was up to him.

He flexed his fingers as he looked at the screens, assimilating information, trying to remain calm despite the adrenalin coursing through his body. He was closer to this star than he had ever flown, even in simulations. He grabbed the throttle and the revector control and began the delicate job of trying to maneuver out of the star's gravity field without the aid of the opnav databox.

For more than a chron, he concentrated on his task. He did not see the flashing warning lights, did not hear the barrage of complaints from the ship's systems: his whole universe shrank until it encompassed only the holograms floating in the cabin around him and the controls in his hands.

Rum-Lem flew the ship delicately around the star, using the gravity field instead of fighting it, forcing the ship reluctantly into hyperbolic orbit.

As he shot over the pole of the star, the holograms displaying his surroundings shifted to display the new information the sensors had received from the far side of the star. The star was home to a planetary system.

The opnav databox announced: "Warning! Enemy ship closing." At least the warning circuits were still working.

He saw the ship immediately, behind him and closing rapidly along a gravity line that passed even closer to the star than his own. There was no ID associated with the ship.

He swore. How on Dalith had the ship followed him again? It was simply not possible.

He watched the ship. For a moment, it deviated from its course and Rum-Lem felt a ray of hope.

He could guess what had happened. The Kivran ship had terminated its jump even closer to the star, and now it was in real danger of being trapped by the stellar gravity field. He watched grimly as whoever was at the controls of the ship fought to extricate himself from his precarious situation.

The ship disappeared behind the bulge of the star, forcing Rum-Lem to concentrate on his own difficulties. He was moving quickly away from the star. But what should he do now? The spacetime curvature precluded another hyperjump, and he had only a short time before his pursuer came into view — if the pilot escaped the stellar gravity field.

He glanced at the display of the star's planetary system. There were four small planets in inner orbits. The closest two were behind him, in full view of the chasing ship. The other two were more or less directly in front of him, and still hidden from his pursuer by the curve of the star. He gauged the distance to the third planet. He had no choice. He revectored and opened the throttle in a race to reach the planet before the pilot of the other ship could see what he was doing.

He was about halfway there when the other ship appeared around the limb of the star. Instantly, it changed course to follow. It was still gaining. As Rum-Lem approached the planet, the Kivran vessel was no more than a chron behind.

It was going to be a near thing. He looked anxiously at the holoimage screens, trying to judge the outcome of the race. Would there be time for him to find a hiding place on the planet's surface?

He was forced to slow down as he approached the planet, to maintain control as he entered the atmosphere. There was no time to perform more than a perfunctory visual inspection of the planet. It was more than half covered with water; swirling patterns of white clouds hid much of the surface. A single continental land mass was visible on the hemisphere facing him, halfway between equator and pole. The center of the land mass was cloudless and reflected back the brownish color characteristic of desert. That was the place for him: the heat would hide the signatures of his engines.

He angled his craft and plunged steeply downward. As he shot through the atmosphere, the scanners informed him that radio transmissions from the planet filled the electromagnetic spectrum. The planet was inhabited.

Rum-Lem's attention was distracted by the approach of the other ship. He had had to slow down too much as he entered the atmosphere; the other ship would be within weapons range at any moment. He crossed the coastline of the continent and fired his retrothrusters for landing, but as he glanced at the scanners he knew he was too late. The race was lost.

High above, in the cabin of the pursuing ship, a light began to glow steadily on a panel.

"Weapon locked on target," the ship announced.

With immense satisfaction in her voice a woman ordered: "Fire."

2
Hwang Lee

Hwang Lee stepped out on to the decrepit wooden balcony, and the muscles around his eyes tightened at the touch of the frigid arctic air. Most of Hwang's body — in fact, all of it except the area around his eyes — was covered by a heating suit set at a comfortable 296 kelvins. He had purposefully refrained from lowering the visor so that he could see the spectacle before him without the nuisance of intervening plastic.

He closed the door behind him to keep the heat inside the ancient cabin, then turned and looked up at the sky.

He wondered what the aurora had looked like in the old days, when it was a purely natural phenomenon. In those days it was intermittent, of course, and surely it could not have been half as beautiful as it was now, but somehow he could not help feeling that something had been lost when the artificial auroras had been turned on seventy five years ago.

Occasionally, though, the particle injectors were reduced to 10% power in an attempt to give tourists what the North Polar Tourist Agency termed in their vid-ads "a sample of what a natural aurora would look like." Of course, the NPTA never relied completely on nature, for it was far too unpredictable. The last thing the NPTA wanted was the possibility of tourists paying good money to see a disappointing show — or even no show at all.

This weekend was one of the two weekends per year when the particle injectors were throttled down to low power, and it was partly this opportunity to see a more authentic display that had drawn Hwang to his great-grandfather's cabin. The other reasons were more complex, having to do with the intractability of the problem he was facing at work and the fact that Ekbu Tbamti, his group leader at the university, had begun a five-day absence from the lab earlier in the day. Hwang was hoping that a couple of days' solitude in the arctic wastes with only the mute aurora for company might inspire him to a new line of reasoning that would lead to a solution to the instability problem plaguing the quantum bubbles.

The ancient, isolated wooden hut had been built nearly a hundred years earlier. Then it had been a primitive structure; now it seemed positively primordial; perversely, it was this very simplicity that attracted Hwang.

The outer walls of the cabin comprised three wooden layers with nothing but air trapped between the layers to provide insulation, a design that worked far better than Hwang had thought possible until one afternoon he had calculated the thermal properties of such a system.

All power in the hut was derived from old-fashioned synthoil. Hwang knew that he would have to do something about that as soon as he could afford it: synthoil was getting to be expensive these days. But it would cost upwards of 10,000 WCUs to convert the building to use power blocks, and it would be at least another year before he could afford that kind of money.

Considering that the cabin had had virtually no maintenance for most of the past hundred years it was in surprisingly good condition. Up here things decayed slowly; the air was permanently dry and even in the summer with its midnight sun the temperature never rose very high. The cabin made a perfect getaway for Hwang. It was remote, inexpensive, and almost maintenance-free.

Now Hwang stood on the balcony and looked up into the sky, his eyes slowly adjusting to the crepuscule. There were only two distinct auroras visible, a far cry from the usual eight or nine. Directly above was a large, red arc, diffuse and sufficiently dim that Hwang could almost convince himself that he could see stars through its glow. Off to the west was a multicolored, flickering curtain that was considerably brighter.

Technically, the local time was shortly after 0800, but time of day was almost meaningless so close to the solstice at these latitudes. The temperature was not cold for the time of year, but even so it would be uncomfortable to remain outside with unprotected eyes for more than a minute or two.

Hwang took full advantage of the short period, gazing in awe at the red arc and experiencing a rare unity with the Universe, losing himself temporarily in his appreciation of the beauty of the almost-natural phenomenon and forgetting his mundane troubles. He watched the display until his eyelids began to hurt with the cold. Reluctantly, he dropped the visor over his face. Immediately he began to feel warmer, but the view of the sky was no longer quite as clear as it had been, and he somehow felt like he was now merely an outsider — an observer, rather than an integral part of the Universe.

His wristcom vibrated.

He tried to ignore the insistent vibration, but the summons had broken his mood. Civilization beckoned, and he supposed he must answer its call.

He lifted his wrist and spoke loudly so that his voice would carry through the microinsulation of his face mask and glove.

"Redirect inside."

He went back into the cabin.

The vidscreen on the wall was lit. "Connection attempt from Ekbu Tbamti," glowed in yellowish letters on a dark green background.

As Hwang removed his outer layer of clothing, he wondered why the group leader was calling him. When Tbamti had left the lab around lunchtime, he had said simply, "See you all in five days." By now he should be relaxing in his Tongan hideaway with his wife and family.

Tbamti deserved the break, for no one at the lab worked harder than its director, who, in addition to supervising a bevy of graduate students and postdocs, was also the lab's chief source of inspiration and principal public relations asset.

Sporadically throughout his career Tbamti had made a point of publishing amusing but scientifically irreproachable papers on some facet of life that was not traditionally the purview of physicists or mathematicians. His papers on such subjects as *The Recipe for the Perfect Ice Cream*; *Bread, Butter and Gravity*; *Why Science Fiction Writers get it Wrong*; and *Camels and Needles: a Study in Wealth* had earned him a large and enthusiastic following among the general public; and, incidentally, a seemingly never-ending stream of grants.

When one added to this his avuncular, larger-than-life personality on the videocasts, the result was a popular, interesting, successful, sought-after man who nursed only one half-secret, unfulfilled ambition: to win a third Nobel.

"Connection attempt from Ekbu Tbamti is being repeated," flashed in a more urgent reddish orange on the dark green background of the vidscreen.

Hwang had removed the insulating suit and was now standing in front of the screen in his ordinary clothes.

"Accept connection," he said.

After the briefest of pauses, the three-dimensional image of his group leader appeared in place of the flat letters.

Hwang recognized the background. The vidscreen was inside Tbamti's Tongan hideaway, and the foreground showed a simply furnished room; through the windows behind Tbamti Hwang could see the blue of the Pacific, the low, early-morning sun reflecting brightly from the undulations of the swell.

Tbamti seemed to fill the hut as he always did, a trick both of his massive frame and the fact that he had a tendency, whether by accident or design, to stand somewhat closer to the vidscreen receptors than most people. He had obviously been wearing a slight frown of anxiety at Hwang's tardiness, but the moment he appeared on the screen the frown was replaced by a hearty smile. His white eyes and teeth beamed delightedly out of the expanse of his enormous black face.

"Ah, Hwang, there you are. I thought for a moment you weren't going to answer."

"Sorry. I was outside, looking at the low-level auroras; they have the injectors turned down to low power this weekend."

"Oh, you're up there are you? Well, rather you than me. Give me sun, sea and sand any day. Anyway, I wanted to let you know that I've been thinking about our stability problem. Have you had any more thoughts?"

It was a measure of the high regard in which Tbamti held the postdoc that he gave Hwang a chance to speak before sharing his own ideas. Unfortunately, Hwang had nothing to say.

"No. That's why I came up here. I thought that maybe if I could get away for a day or two, I might come up with something."

"Well, take a look at this, will you? If you think it's OK, maybe you could give it a try before I come back. It might be the solution we've been looking for. At least it's a possibility."

Hwang noticed for the first time that there were several sheets of paper in Tbamti's hand. Tbamti stepped forward and did something out of the vidscreen's field of view. Immediately, a slot by the side of Hwang's screen began to eject sheets of paper.

Tbamti continued: "I may have come up with a solution; or maybe I've missed something and you'll have the pleasure of pointing out my mistake. Anyway, I'll let you take a look at it. Get back to me with your thoughts."

"OK. Thanks."

"Good-bye, Hwang, and enjoy the auroras."

Tbamti leaned forward and touched something. The screen went blank and then, a fraction of a second later, a holographic view of Denali rising into an azure sky appeared in his place.

Hwang walked to the old table that was one of the few pieces of furniture in the cabin, studying the sheets in his hand. As he looked at them, he yet again appreciated how lucky he was to be working with someone like Ekbu Tbamti. No; he corrected himself, there was no one *like* Ekbu Tbamti. Tbamti was one of a kind.

Just over a year ago, Hwang had turned down a lucrative offer from a high-tech company to join joined Tbamti's élite research team. He had never regretted his decision. In the course of the past year, he had become Tbamti's confidant and, as much as Tbamti had one, his favorite colleague. Neither was afraid to contact the other whenever he was having difficulty with a problem. Working together, no problem had stumped them for more than a few days. Until this past month.

Thirty days ago, Hwang had finally succeeded in creating and confining quantum bubbles.

At first he had been ecstatic. Flushed with enthusiasm he had brought Tbamti down to the lab: a painted room with windows that were permanently shuttered closed on the ground floor of the physics tower at Rabundi University. Wires and equipment of various vintages were strewn all over the floor, giving the impression more of a disorganized storeroom than the laboratory of the world's greatest scientist. The centerpiece of it all, humming quietly in the very center of the room, was a massive metal box — the guidance block — some four meters long, a meter wide and a meter high.

The box sported an array of red lights on its side; the lights flashed on and off in what at first looked like a predictable pattern until one studied it for a while, when one would realize that while each light seemed to obey a simple periodic switch, the pattern of lights as a whole changed chaotically.

But it was not the lights that were the heart of the machine: they were merely indicators of its status. The metal block was topped by a glass cylinder perhaps 10 centimeters in diameter and running the length of the block. Each end of this cylinder was capped with a white plug from which ran a large cable. At intervals of a few centimeters along the length of the cylinder, black collars fitted tightly around the glass. It was within this cylinder that the quantum bubbles were created. Sharing the top of the guidance block with the cylinder was a split-beam laser, used to look for minute changes in the local gravity field.

The purpose of the experiment was the reigning Holy Grail of physics: to provide the first incontrovertible proof of the phenomenon dubbed by the press "antigravity."

Hwang and Tbamti stood in one corner of the room beside the control panel. Hwang flipped a switch to reset the experiment and instantly the lights on the block all went out, except for one in the upper left hand corner.

"Get ready," Hwang warned. "They appear very quickly, and they don't last long."

Hwang pressed a button, and the lights on the side of the block began to flash in a simple, repetitive pattern: two red waves, each commencing at one end and moving towards the center, where they appeared to collide and destroy each other, just as another pair of waves was born at the two ends. A low hum from the equipment grew louder.

Suddenly, the hum changed, and an abrupt, high-pitched tone overlaid the low-frequency sound. At the same moment the left-hand wave dissolved into a chaotic pattern of flashing lights.

Inside the cylinder a blue bubble about two centimeters in diameter appeared and detached itself from the leftmost plug, travelling slowly to the right, along the axis of the cylinder. The bubble vibrated like an unstable soap bubble, although it appeared to be made of nothing more substantial than light. It moved away from the plug, travelling down the length of the cylinder.

The bubble lasted for no more than half a second, during which time it travelled perhaps 25 centimeters down the tube. Then it seemed to dissolve into nothingness. The blueness got fainter and the bubble just seemed to ease itself out of existence, without actually contracting or expanding as it did so.

Just before the bubble disappeared, a similar bubble formed at the other plug. The lights on the right-hand side of the guidance block ceased their wavelike pattern and dissolved into chaos. The bubble detached itself from the plug and moved towards the center, just like the first. This one did not travel as far. Almost as soon as the scientists were aware of its existence, the bubble began to dissolve in the same manner as its twin.

A second and a half later, it was all over. Both bubbles had disappeared and all that remained were the lights, flashing randomly.

A huge smile creased Tbamti's face. "Well done, Hwang. It works!"

"Yes. Sort of. But I can't keep the bubbles stable for long enough. No matter how carefully I set everything up, the bubbles simply will not appear at the same time, and they never make it to the center of the tube. And even if they did, I'm certain I wouldn't be able to control them once they came close to one another. I don't know how to keep them stable. I've tried everything, but nothing seems to work."

"Well, never mind. We should celebrate the progress you've made. We can figure out how to improve things later. There has to be an answer."

But if there was one, it was proving extraordinarily elusive. Tbamti and Hwang had spent a whole month since that first run, trying to understand in detail the dynamics of the quantum bubbles. They had made some breakthroughs: the equipment could now be relied on to create bubbles at the two ends of the cylinder more or less simultaneously, and they had discovered that by shrinking the bubbles to a diameter of no more than a centimeter they were much more stable and often traversed a meter or more before dissolving back into the nothingness from which they had come. But antigravity still eluded them

Tbamti and Hwang were both convinced that the path to antigravity lay in the phenomenon of quantum bubbles, but they also knew that there was no hope of a detectable effect unless they could stabilize the bubbles. The bubbles had to be allowed to evolve without disappearing before there was any chance of an antigravity effect appearing.

After a month without progress, even Tbamti was beginning to become discouraged, and although he had tried not to let his young coworker know how frustrated he was, Hwang understood that the laureate was beginning to think that another major breakthrough would be necessary before they could make any further progress. But perhaps Tbamti had now made the breakthrough they needed.

Hwang's brow furrowed as he tried to follow Tbamti's miniscule script. According to Tbamti's calculations, their problem lay in trying to constrain the quantum bubbles too tightly. The collars along the length of the cylinder were fed with radio energy at a frequency of precisely $14 \cdot 025$ megahertz, which Tbamti's calculations had long ago indicated was what he called the "frequency of optimum coupling."

But his new calculations suggested that, for the quantum bubbles to maintain their integrity, they had to be allowed to evolve for short periods without being affected by external constraints. Counterbalancing this was the fact that, if the radio energy was cut off completely, the bubbles would simply evaporate into nothingness.

Tbamti was proposing a simple, almost a trivial, modification of their present experiment. He proposed that the radio energy should be switched on and off several times per second.

Hwang sat at the table and considered Tbamti's notes carefully. At first he was dubious that such a simple change could possibly make any real difference, but the more he thought about it, the more excited he became.

The basic idea was very simple. When the radio energy was not turned on, the bubbles would evolve naturally, following their tendency to return to the nothingness from which they had been created. When the energy was available, they would be constrained and would extract energy from the radio waves. By alternating between the two states while the bubbles were being driven forward by a directed impulse, then it seemed possible that the bubbles could be made to drift down the column until they came close enough for them to interact. And it was this interaction that was the whole point of the experiment.

Hwang's stomach rumbled. He glanced at his wristcom and discovered that he had been engrossed in Tbamti's equations for more than three hours. It would be late evening by now back at the university. If he were to leave immediately, it would be the early hours of the morning before he arrived.

Hwang did not stop to think. He had to know whether Tbamti's changes would work.

He bundled Tbamti's papers under his arm, recovered the things he had brought with him for the weekend, grabbed a package of food from the refrigerator, and hurried to the garage that abutted the cabin.

His skycar looked newer than it was. It was nearly twenty years old now, not that much younger than Hwang himself. It had a ceiling of fifty kilometers and a cruising speed of only 5,000 kph. Still, it was reliable and cheap to run, and met Hwang's limited needs. The skycar would last him a few more years yet. He clambered into the plastic shell, sealed the door, and started the ground motor.

As always, the launch was a little jerky. There was a problem somewhere with one of the detonation thrusters, a sticky valve perhaps, but Hwang's practical expertise in such matters was limited, and the jerkiness had not yet reached the point where it was worth the expense to have it fixed; so the craft shuddered slightly as it lifted from the ground. Then it smoothly reoriented itself for the journey and began to gain both speed and altitude.

As the airspeed indicator moved through 500 kph, the frame of the vehicle began to rattle as it always did. The rattle was always worse up here in the arctic, accentuated by the slight shrinkage caused by the cold arctic air. As the car accelerated through 1,000 kph, the rattling gradually faded away and was replaced by the gentle drone of the turbopulse engines.

Hwang switched off the cabin lights and began to eat. He glanced at the course chart: his route would take him close to the pole and then south across Scandinavia, central Europe, the central Sahara and thence to Rabundi. Estimated total flight time was almost exactly three hours.

Now that he was airborne, Hwang's excitement faded and he suddenly felt exhausted. It had been a long day. Within moments of finishing his food, he leaned back, closed his eyes, and dozed.

When he awoke, he was passing over northern Africa. The Time To Landing indicator was down to forty five minutes. He could see little through the window, but in the distance was an enormous agglomeration of lights. Even without the navigational screens to tell him, he would have realized that he was flying over the Sahara, one of the few remaining unpopulated areas in the world. The distant lights were from Kalhad, the second-largest city in Africa.

He settled back and enjoyed the view as the onboard computers guided the skycar towards its destination.

The skycar began its long descent and the blackness below gave way to a vista of lights as the desert fell behind. Below him now was jungle; unlike the desert the jungle was populated, and there were dense clusters of lights now in all directions. The car made a few adjustments, guiding him around the major population centers, and it was not long before the bright lights of Africa's largest city lit the horizon. Ten minutes later, he was on the ground in the skycar park at Rabundi University.

It was a little after three in the morning, and the city was as quiet as it ever was. He saw no more than a dozen people as he walked to the stop for public ground transportation.

He signaled his presence and about three minutes later a robotbus trundled up to take him to the university. According to his wristcom, it was half past three when Hwang submitted to the retina scan and the doors of the physics tower slid open to admit him.

He went immediately to the lab. The equipment was all there, just as he had left it yesterday. He checked the energy in the power cube — it was still more than three quarters full — and switched on the computers.

The changes that Tbamti had suggested should be simple to implement: a few minor alterations in the control program should be sufficient.

He finished making the changes shortly after five.

Hwang debated whether he should wait until someone else was present before running the experiment. Tbamti always wanted at least two people present when the experiment was running, as a precaution against accidents. But the computer controlled everything, and the minor changes Hwang had made to the program could not possibly cause an accident. And anyway, if anything did go wrong, the computer would simply shut everything down.

He began to apply power.

He switched on the reference laser and its detectors. The beam from the laser split into two parts. One part was reflected by mirrors so that it traversed the top edge of the guidance block. The other part went directly from transmitter to detector, passing above the center of the cylinder, where the two bubbles were supposed to meet. A computer compared the signals from the two lasers and produced a readout that was continuously updated. Right now, there was no deflection: both beams matched their calibration. Full gravity was acting along the entire path length of the beams.

The computer confirmed the integrity of the operational circuits and Hwang pressed the button for the run to begin. He was sweating. For the first time, he found himself thinking that this time there was a real chance the experiment would work. This time, antigravity might really be created and Tbamti might be about to get his third Nobel. Hwang, if he was lucky, might be about to get his first.

The red lights along the side of the block began to ripple in unison, starting at the edges and then sweeping slowly inward to collide and disappear at the center; then they reformed at the edges and repeated the sequence.

Hwang counted the sweeps and watched the digital meters on the screens. On the tenth sweep, the meters, as they always did, briefly indicated the formation of quantum bubbles. They swept into existence for a fraction of a second, the only visible confirmation a slight kick on the meters.

On the eleventh sweep, the kicks were more pronounced. This time, Hwang could convince himself that the nearer of the two bubbles had lasted long enough for him to see it.

On the twelfth sweep, there was no doubt. The bubbles were definitely visible. Still too unstable to be picked up by the waves as they passed down the cylinder, they shivered unsteadily for several seconds before dissipating.

On the thirteenth sweep, the bubbles appeared and phase locked themselves to the sweep of the lights. Slowly, they began to drift towards each other.

The drift was painfully slow. The sweep of the lights towards the center was much slower than before the bubbles had formed. The meter indicating deviation from gravitational symmetry stayed in dead center. The hum of the power transformers switched on and off several times a second, like a burst of high-speed, old-fashioned Morse code. And still the bubbles remained intact. They continued their stately progress towards the center of the cylinder. They travelled farther than they had ever done before. Hwang's heart was racing. This time it really was going to work.

Something changed as the bubbles came within about a meter of each other. A vibration, too low to hear, began to shake the room. The energy being consumed by the experiment increased, and the bubbles began to become oddly indistinct.

For a moment Hwang thought that the bubbles were becoming unstable, but then he realized that they were oscillating, too rapidly

to see clearly, but slowly enough that somehow the oscillations were producing a sound wave that filled the room — even though the bubbles existed in a vacuum.

He could not quite hear the note, but he could feel it, shaking the lab. A few seconds later he began to hear something. It was deep, a veritable proslambanomenos of a note. As the bubbles continued to drift closer, the frequency of the note increased. He covered his ears, keeping his eyes fixed on the bubbles, which were now beginning to glow brightly.

Any second now....

When it happened, it was not at all what he and Tbamti had expected. Instead of creating a tiny volume in which gravity could not propagate, the bubbles began to spin around one another like a pair of miniature orbiting binary stars. Simultaneously, the noise abruptly ceased. Hwang removed his hands from his ears. The power meter had gone crazy: the experiment was suddenly consuming an unbelievable amount of energy.

Before Hwang could react, the electric current pouring from the power cell melted a bus-bar, cutting off power to one half of the experiment.

The two bubbles shivered momentarily, and then they touched.

The collapse of the physics tower greeted the early-morning arrivals at the university. Later, there was unanimous agreement that there was no explosion. The building simply collapsed, without warning and seemingly without cause. The only oddity, insisted on by a pretty young undergraduate who had been passing the building a couple of minutes before its collapse, was that she had felt the ground trembling as she had walked by.

The university security computer indicated that the only person in the building at the time of the collapse was Dr. Hwang Lee, a postdoctoral student working with Professor Ekbu Tbamti.

Lee's office was on the fifteenth floor, but generally he worked in a laboratory on the ground floor. He could have been in either place, or anywhere in between. In any case, it was hardly possible that he could have survived the building's collapse. He would either have fallen to his death or been crushed. Still, until a body was found there was always hope, and lifting machinery was quickly brought in to try to sort through the rubble to look for Dr. Lee.

The pretty undergraduate was certain that no lights had been on when she had passed, and Lee's office was on the side of the building that would have been visible to her, so the Disaster Relief Team dug through the debris toward the shattered laboratory, whose shutters would have prevented any light escaping.

It took them more than six hours to reach the laboratory. Ekbu Tbamti was there, freshly arrived from Tonga, when a worker came over to him and said, "OK, sir, I'm sure we've reached it. But it doesn't look anything like you said it would."

Tbamti cursed with frustration and after donning protective gear followed the worker through the precariously shifting rubble to what remained of his laboratory. His description of the lab had been complete and precise; was it possible that these fools had been so stupid as to excavate the wrong part of the building?

But Tbamti immediately recognized the remnants of his laboratory. There were the single-event holograms of Tonga on the wall; there were the conduits that brought the utilities into the room. There could be no mistake: this was his laboratory all right. Except that two things were missing. There was no sign of a body. But neither was there any sign of the experiment. Hwang and all the apparatus associated with the quantum bubble experiment had disappeared.

3
Lystra Ten-Wer

The woman sat upright in bed, her arms clasped around her knees as she rocked slowly backward and forward. She looked to her right, where her partner breathed easily in deep, relaxed sleep. Until late last night, she had been expecting that they would reregister as partners for another cycle when the current registration ended in just a few rotations. But now that expectation had been reversed, and her mind was filled with a storm of conflicting thoughts and emotions.

The trouble, as she freely admitted to herself, was that for the first time in her life she had permitted herself to fall in love with her partner. It had happened gradually, almost imperceptibly, and it was only recently that she had begun to come to terms with the new emotion that had slowly been stealing over her. She had even had thoughts about making the relationship permanent, although she had not said anything out loud for fear of scaring him away. Men generally were reluctant to certify relationships as permanent. But he, too, was in love with her; she was sure of that.

It seemed like a perfect match, the kind the holoimage broadcasts were always pushing to the masses as the ideal for a happy life. It seemed perfect at all levels: physical, emotional, and even, to the extent that she thought in such terms, spiritual.

But everything had turned to disarray with his quiet confession this evening after they had coupled and then separated for sleep.

She was on the verge of sleep and his words were spoken quietly, so that she had heard them but not fully understood their import.

"Darling, I must tell you something," he had said. "I don't feel like I can continue our relationship unless I share this with you."

Her response had been a wordless grunt as she hovered just this side of sleep.

"Please, don't think of me any differently. But you need to know this. I'm not really from Kivra. I'm a Dalithian spy."

Somehow, incredibly, the news had not jerked her into wakefulness. Perhaps it was the bland emotionless tone in which the planet-shattering information had been imparted. Perhaps she was just too relaxed after their coupling. Whatever the reason, her brain had simply noted the information and then slid into sleep.

It was only later, in the middle of the night, when she woke from a bizarre, disturbing dream which featured the ominous blue sky of Dalith, that she remembered his confession. As she came fully awake, she discovered that sweat was dribbling down her body despite the carefully controlled climate of the apartment.

Unable to sleep, she sat rocking gently backwards and forwards, trying to come to terms with her partner's confession.

There was no question of them staying together now. Obviously he hadn't realized that, otherwise he could hardly have been so blasé about his announcement. But it was impossible: a rising star at the Ministry of Peace and Security could not cohabit with a confessed Dalithian spy.

No, the the question she was wrestling with had nothing to do with whether they could continue to cohabit. It was a much simpler one: would she tell Supervisor Qwilm when she reported for work in the morning?

She regarded the sleeping form at her side. She would be betraying him. If she told her supervisor, at the very least her partner would "disappear". He would never be heard from again. Quite possibly it would mean his death. Was she capable of sending her partner to his death?

He had trusted her by telling her his secret, obviously thinking that while she might have to wrestle with whether to continue the relationship, the secret itself was safe with her. But was it?

They had been together for nearly a full cycle, and it had been the happiest cycle of her life. He had been like a breath of fresh air in the

stale ordinariness of her existence. That freshness was now explained, of course. He could hardly help being different. He was from Dalith. She wondered how a Dalithian had managed to fool the authorities and lead an apparently normal life here at the very heart of the Empire.

She considered this problem for several chrons, as an alternative to wrestling with the decision that confronted her. Eventually she gave up. She could think of no way in which a citizen of Dalith could possibly take a functioning place in Kivran society without being detected.

Yet apparently he had succeeded. As she considered this, she began to realize the implications. He had admitted that he was a spy, but the ramifications of this statement had not at first been obvious. Yet the more she thought about it, the more it struck her that the Dalithians must have gone to immense trouble and surmounted many obstacles in order to place him here without being detected. Surely they would not go to such lengths without a purpose. But what could that purpose possibly be?

Could it be that their meeting towards the end of last cycle was not an accident? Had it all been arranged that they would meet and that he would then play on her emotions? Had their cohabitation merely been part of some complicated design? Surely not. After all, although she did work for P&S, nothing of any real importance was entrusted to her. She merely monitored security reports from the robotships in the demilitarized zone, hardly something that would interest a Dalithian spy.

And anyway, surely the Dalithians, contemptible and stupid though they undoubtedly were, knew better than to expect her to share even what little she did know with a partner, especially in their first cycle together?

Even more strange, why had he chosen this moment — almost on the eve of the new cycle, after they had all but agreed to renew their relationship — why would he choose this moment to jeopardize that relationship by making his confession?

She stretched out a hand to wake him and ask these questions; but something stopped her, and she withdrew her hand and instead continued to rock and hug her knees and ponder her questions.

She considered another side of the matter.

Rather than try to understand his motives, she simply accepted his statement as fact. He was a Dalithian spy. Did that really matter?

She certainly owed him a lot, for he had made her very happy, but did she not owe the Empire and its society far, far more? For this was the society that had accepted her when she had arrived from her backward world to attend the Kivran Imperial University. This was the society that had given her a job and a purpose in life. She looked across the room to the far wall where a small holoimage of the emperor hung, looking benevolently out over the bed with unseeing eyes in which she was sure she could detect both kindliness and justice.

She owed the emperor everything, really. Not personally, of course, for she had never met him and never would. He did not even know of her existence. She was merely one of his 100 billion subjects, of no real importance in the grand scheme of things. But still, as she looked at those intelligent green-brown eyes smiling at her out of the handsome, middle-aged face, she knew where her allegiance lay. Almost without knowing it, she had made her decision. She would inform Supervisor Qwilm in the morning.

She momentarily considered warning her partner about what she had decided, but she immediately dismissed the thought. That would be the act, not just of a traitor, but of a *cowardly* traitor. She tensed reflexively at the thought. If there was one thing Kivrans could not be accused of, it was cowardice. They had always stood firm in the face of Dalithian aggression and duplicity. Kivrans were never cowards.

She remained upright in bed for a while, motionless now and silent. Then she threw a tiny, tight, thin-lipped smile at the holoimage of the emperor, released her knees, and slid down once more into the warmth of the bed.

Firstmeal would have been a tense affair, except that, as usual, her partner had left early without disturbing her. His job as a manual worker in the palace gardens required that he work long hours, but it also meant that his body was always healthy and strong, unlike her own, which always seemed vapid and easily tired.

She ate her meal mechanically. She gave no thought to reconsidering her decision. In fact, she gave little thought to anything at all. Her mind was made up; now it was merely a matter of going through the motions.

After the meal, she left the apartment and lined up with the other occupants of the apartment block as they awaited the hoverbus to take them to their workplace. The line, as always, was long.

The hoverbus arrived on time. She climbed aboard and took a seat. A man seated not far away looked at her with concern, as if her troubles were somehow written on her features. She made an effort to rid her face of all emotion.

Fleetingly, she wondered whether the man might be available for the next cycle. She saw him every day, although she knew nothing about him. He was dressed casually in loose clothes, indicating that he had a low-level job. Perhaps, like her partner, he was a gardener. He had that weather-beaten, browned visage that one associated with an outdoor occupation. Maybe she would ask him in a rotation or so if he was available. He had an understanding, caring look, as if he realized that she was in some sort of trouble. He looked like he wanted to help.

She looked away and gazed mindlessly out the window as the bus made its way along the tree-lined hover route towards the center of the city. The journey lasted no more than fifteen chrons, then she was disgorged into the docking corridor along with most of the other passengers. She walked along the corridor and into the building, where she took the elevator to the 91st floor. She stopped at the receptionist's desk.

"I'd like to see Supervisor Qwilm at his earliest convenience."

The receptionist, a young female, looked up at her and smiled a pitying sort of smile.

"He's already made an appointment for you. You may go straight in."

Ordinarily, this coincidence would have struck her as bizarre. Whole cycles went by without people of her grade being invited to a supervisor's office. Yet, this morning of all mornings, he had obviously been expecting her. She headed for Supervisor Qwilm's office.

The pore pattern on her cheek was scanned, and the door of the supervisor's office slid silently open.

Supervisor Qwilm's office was not much larger than her own, in keeping with the relatively minor distinctions between social classes mandated by the emperor. His holoimage screen, though, was considerably larger than the hers — this one filled the whole of one wall — but its contents were no different from those in any worker's office. His chosen scene was of the inside of a wood. The sky was invisible, hidden by a canopy of overlapping leaves that made the wood dark and a little eerie. There was the sound of a stream not far away, but the only movement on the image itself was from a slight wind: the

gentle movement of small branches, the occasional fall of a leaf. She could almost feel the wind brushing her face.

"Good morning, Lystra Ten-Wer. You have something to tell me?"

Her eyes moved reluctantly from the holoimage to meet those of Supervisor Qwilm. She wondered briefly how much he knew about her. After all, he was responsible for nearly a thousand people, of whom she was merely one, and not a particularly important one at that. He was smiling at her: a jovial, apparently genuine smile of friendship. He went so far as to stand, a traditional mark of respect rarely seen any more, and one that made her feel a distinct warmth towards him.

"Yes," she said. "It's about my current partner. He told me last night after coupling that he is a Dalithian spy."

The words came out fluidly and effortlessly. The hard part had been making the decision; once that decision was made, it was surprisingly easy to go through with it.

The supervisor's smile broadened. He seemed unsurprised by her revelation. She tried to read the strange expression that now appeared on his face, but it was some time before she identified it: Supervisor Qwilm was looking at her with pride. She wondered fleetingly if this had all been some sort of a test, but the thought was smothered even before it could be fully formed.

"Thank you," said Supervisor Qwilm. "Could you give me his name, please?"

She stopped, overcome by a sudden panic. It was a simple question. She had lived with the man for nearly a whole cycle. They had shared their deepest secrets and their greatest desires. Yet now, all of a sudden, she realized that she did not know his name.

A gentle, hummy sigh of contentment escaped her closed lips. She was leaning against something hard, seated on something soft. Even with her eyes closed, she knew that the hardness was a tree trunk and the softness a bed of leaves lying atop spongy, fertile soil. There was a warmth to the day — not the sterile warmth of an office, but the honest, natural warmth of the open air. Her eyes were closed. It was too much effort to open them. She relaxed, and went back to sleep.

When she awoke, nothing had changed except that the tree trunk now dug into her back, slightly hurting her. She leaned forward, her eyes still closed, and reached back to rub the area between her shoulder blades.

"Can I do that for you?"

She opened her eyes and found herself looking into the empathetic eyes of a tall man about her own age. He was standing in front of her, looking down at her with a smile.

"Yes, please. If you would."

She turned slightly and the man stepped forward and knelt down to rub her back. It felt wonderful. She closed her eyes and shivered at his touch.

Nothing changed for several chrons; then eventually, he asked, "All right now?"

"Mmm, yes, thank you."

"May I sit with you?"

She opened her eyes. "Yes, please do."

As the man seated himself beside her, she examined their surroundings.

They were in a wood. The trees were tall and sparse, but the leafy canopy was so dense that the sky was invisible. Occasionally, just for a fraction of a second, an intense burst of oddly yellowish sunlight would penetrate the greenery, only to be immediately obliterated by the gently moving canopy far above their heads. The ground sloped away towards a declivity to her right, from which direction came the sound of running water.

At first, that was the only sound she noticed, but as she listened she realized that the air was filled with birdsong. She did not recognize any of the tunes, but she tried to guess what each bird would look like from the sound it made.

There was a soft *chrrr-chrrr* that she thought must come from a small bird. She imagined it as yellow and blue, scurrying around on the ground, looking for worms. And a *pibbitt-pibbitt-pibbitt*, more strident and almost raucous, the sound of a large bird, high above in the greenery somewhere. And a whistling song, like a maestro on a flute-like musical instrument but pitched impossibly high and playing the notes staccato and in frantic haste, obviously the sound of a small songbird.

"You got the last one right, at least," the man said, reading her thoughts.

"It changed notes so quickly, you see; it has to be a small bird."

"Yes, I see." The man nodded in understanding. "Nice here, isn't it?" he asked a moment later.

"Mmm, yes."

"Ever been anywhere like it before?"

"No. Is it always like this?"

"Oh, yes. Always."

They remained silent for some time. At length the man spoke again.

"I'm Rum-Lem," he said. "What's your name?"

"Lystra. Lystra Ten-Wer."

"It really is nice here, isn't it? So peaceful."

"Yes, it's wonderful."

He looked at her with such evident absorption that she felt bound to reciprocate. She examined his face. He was a handsome man. His face was soft and gentle, his eyes large and almost liquid. It was a kind face. He was smiling at her.

He said, "Forgive me. It's rude of me, I know. But I can't help it. It's just that I feel like I've seen you somewhere before."

Lystra continued to examine his face carefully, trying to remember. She felt certain she would have remembered if she had ever seen him before. She shook her head.

"No, I'm sorry. I don't think so."

He shrugged. "Never mind. Just a fancy. Lystra; it's a nice name. Were you named after someone?"

"Yes. According to the records it was the name of my birth mother's mother."

"Tell me more about yourself."

She shrugged. "There's not much to tell. I'm not a very interesting person."

He laughed. "Now that's not possible. Someone as pretty as you is interesting merely by virtue of your existence."

Lystra tried hard not to blush, but didn't quite succeed. It was a long, long time since someone had paid her such a compliment. Part of her brain dived deep to find the last such occasion. It was when she was still undergoing her formal education. A young man had said something very similar. After a short time, they had agreed to an unofficial pairing. It hadn't lasted long and they had never seen each other since.

"You look like you're remembering. Tell me about yourself. Tell me everything."

Lystra's cheeks flushed again.

"You're not really interested."

"On the contrary, I can think of nothing I'd rather do than sit here and while away the afternoon listening to you talk about yourself."

"Well, really there's nothing much to tell, but if you insist...."

She smiled a smile of happy defeat, and began to reminisce.

"I was born on the planet Eb. You've probably never heard of it. It's a small, mostly agricultural planet on the outskirts of the Empire, one of the Outer Planets, not far from the demilitarized zone.

"I was born in the main birthing hospital in Eb-wan, which is the largest city on Eb. I was the result of a coupling between a maintenance engineer on a farm and a bureaucrat in one of the government offices. I guess I was some sort of a mistake. The records don't show that permission was ever given for my conception. Normally I would have been aborted, but my birth mother applied for exemption under the Desirable Errors Decree, and she was granted permission to carry me to term. The scans showed that I would be intelligent and therefore worth saving.

"It was good of her to keep me; I don't think most people would have done that. I've met her a couple of times, secretly" — Lystra was slightly surprised that she felt no qualm of embarrassment at admitting this illegality to a man whom she had only just met — "and she seems quite pleased at the way things have turned out. As am I, of course."

"And I." He flashed her a smile of encouragement. "Carry on."

"Well, it's all rather boring, really. I was educated on Eb. I did well academically, as the pre-birth scans had predicted. My adoptive parents loved me and were very proud of my achievements. They died in a crash just after I was accepted at the Kivran Imperial University. I still miss them.... Anyway, I did well at university, and when I graduated I was offered a job in the Ministry of Peace and Security. I've been there more than five cycles now."

"Do you intend to make a career out of P&S?"

She shrugged. "I guess so. They tell me I have an aptitude for the work and mostly I enjoy it. It's quite interesting."

"What kind of work do you do for them?"

She hesitated a moment before answering. "Monitoring work."

"What kind? Domestic, Remote or Space?"

"Space. Occasionally a bit of Domestic. Nothing important, though. But I'm not allowed to talk about it."

"Come on, you can tell me. I'm your friend. Do you deal with intercepts from Dalith?"

She said nothing.

"The demilitarized zone?"

She remained silent.

"I bet that's it. You work on monitoring intercepts from the demilitarized zone, don't you?"

"I'm sorry. Let's talk about something else."

"Do you like it here?"

"Yes. I wish I could stay here forever, just like this."

"For ever and ever?"

"For ever and ever."

"What about partners? How's that side of your life?"

Lystra shrugged. "You know, the usual. I had a few partners when I was at university. None lasted very long."

"Nothing since then?"

"No. Too busy."

"Any regrets?"

"No, not really. That's the way of it, really, isn't it?"

"Don't you sometimes hanker after a stable many-cycle partnership? A proper pairing?"

"No, I think that would get boring. And it wouldn't do my career any good. They tend to view long-term relationships with suspicion at P&S."

"But there are more important things than your career, though, aren't there?"

Lystra thought for a moment, then shook her head. "No, I don't think so, not really."

"You enjoy your work, then?"

"It gives me great satisfaction."

"But you like it better here?"

She looked around, drinking in the peaceful tranquillity of the woods.

She said, "It *is* nice here, isn't it?"

"Yes, it is. You know, you could stay here forever if you told me a bit about your work. I could stay with you if you'd like that."

"No," Lystra shook her head. "My work is my life. And anyway, like I told you, I'm not allowed to talk about it. I could never betray the trust they place in me."

"Never?"

"No, I don't think so."

"Well, let's just enjoy this afternoon. Lean back and close your eyes."

She did as he suggested. The tree pressed itself once more between her shoulder blades. She fidgeted a little to get comfortable. Then she relaxed. Within moments she was asleep.

From somewhere beyond her consciousness a voice, clinical and female, said, "OK. That's the end of the run."