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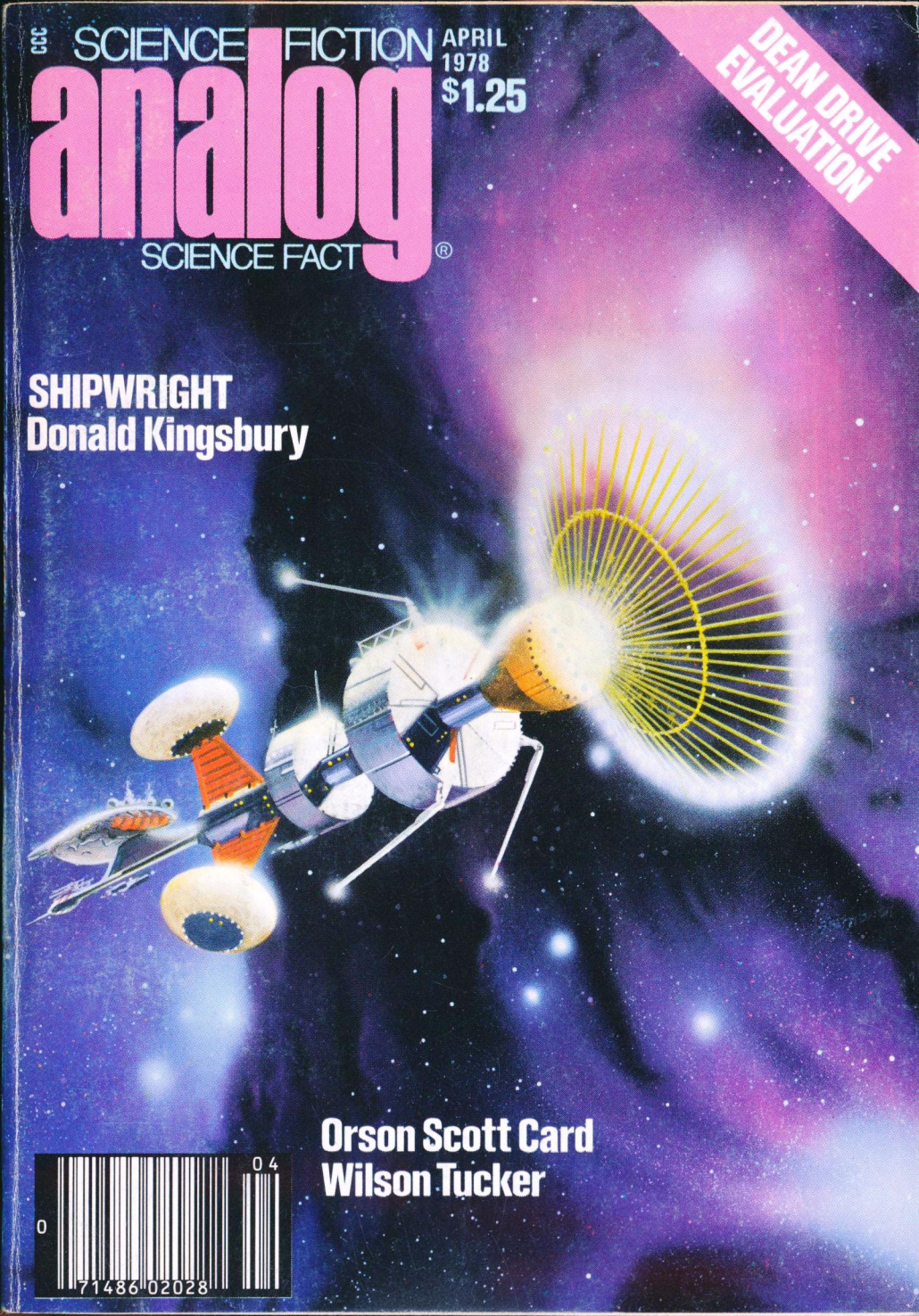

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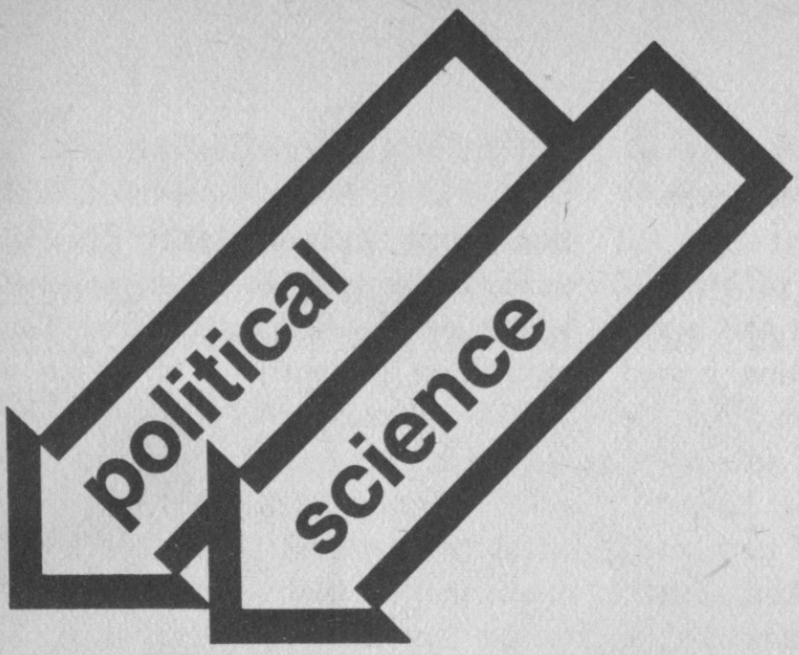

revisited

editorial

If patience is a virtue, then tenacity is an asset.

In the February 1977 issue of Analog, Jeff Rovin told about his frustrations in trying to get answers out of President Ford in regard to key questions on science and technology.

Rovin's article, "Political Science," explained that he had received assurances in March 1976 from Press Secretary Ron Nessen that President Ford would be glad to answer Analog's questions about the future of science and technology, as seen from the White House's point of view. Rovin sent a list of questions that he and I hammered out together here in the Analog office.

In August 1976, with the Presidential election campaign heating up, Nessen wrote to Rovin that "an extremely hectic spring and summer for the President" would make it impossible for him to answer Analog's questions.

The hallmark of a successful writer is tenacity. No one becomes a successful writer, paying the weekly bills with the output of the typewriter, unless that person has a *lot* of stubborn determination deep down in the guts. Jeff Rovin is a highly successful writer, and he was tenacious enough to follow up his disappointing first crack at the White House.

He wrote to President Jimmy Carter, asking the same questions that he had sent to his predecessor. President Carter turned the problem over to his Media Liaison man, Harlan Lebo, who took immediate action and—in less than a month—returned detailed responses to each question. The answers were culled from the Office of Science and Technology Policy, the National Aeronautics and Space Administration, and the National Institutes of Health.

What follows here are the questions that Rovin sent in, the answers that Lebo sent back, and the comments that the Editor has about those answers.

Q: Is it politically viable for the United

States and the Soviet Union to spearhead an international manned expedition to Mars. If so, when?

A: A manned expedition to Mars is not considered realistic at this time. On the basis of information gained from the Viking landing on Mars, we have gained considerable insight to this planet. This does not, however, preclude the possibility of unmanned expeditions in the future. And, at such a time, a cooperative program with the USSR might be politically viable.

C: A rather conservative, noncommital answer, in the finest tradition of NASA's ultraconservative public relations policy. If Viking has told us one important fact about Mars, it is that a human expedition could survive there about as easily as they now survive in Antarctica. As Richard Hoagland pointed out in our May 1977 issue, a manned expedition to Mars could be easier *to field than automated roving Viking-type landers—and much more rewarding.*

Q: Researchers involved in molecular and genetic study have expressed concern over the fact that artificial mutations could escape from laboratories and contaminate the world. What should the safeguards be in such research?

A: Scientists interested in and involved in research on recombinant DNA have worked out a series of proposed safeguards designed to confine any artificial mutations created that might pose a biological hazard outside the laboratory. These proposed safeguards, termed the "NIH Guidelines" because they were created under the auspices of the National Institutes of Health (NIH), serve as the basis for Congressional legislation now being considered. The guidelines, presently in effect on a voluntary basis, are considered by most scientists to be sufficient to deal with the potential hazards that have been contemplated. A prolonged examination of such hazards has revealed that many of them were initially exaggerated.

C: The Congress is debating the advisability of passing Federal laws intended to govern recombinant DNA research; such laws would inevitably lead to Federal control *of this branch of research. And others, no doubt. The Federal government, to date, has been a generous financial sponsor for basic research, but has largely left control of such research to the researchers themselves. It's a bad idea to allow politicians and government bureaucrats to control research. At best, you get shortsighted, goal-oriented programs that are little more than glorified engineering projects (such as the NIH's artificial heart program). At worst you get Senator Proxmire and his know-nothing attitude destroying our future by cutting down any research ideas that don't please him.*

Q: NASA studies show that the United States can build a hydrogen-fueled, economically attractive, mach-3 supersonic transport that would produce minimal air pollution. Should the government support the development of

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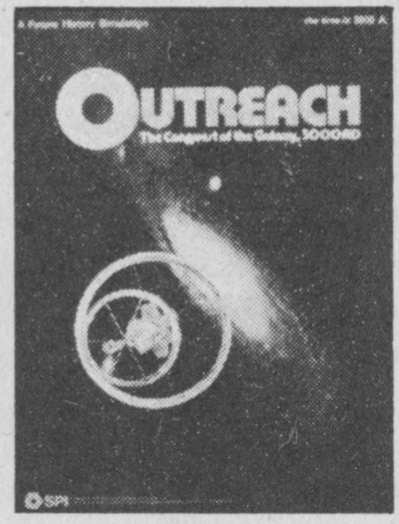

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such a program, particularly in light of the high rate of unemployment in the aerospace industry?

A: A hydrogen-fueled supersonic transport may some day be an economic and environmentally acceptable technology. However, it does not seem to be a high-priority item at present.

C: Left hand isn't aware of right hand department. NASA awarded a quarter-million-dollar contract to Lockheed late in 1977 to study the design for a hypersonic, hydrogen-fueled, airliner that could cross the Pacific in less than three hours.

Q: KMS Industries was able to produce a laser-fusion reaction after only four years of research. Government supported laboratories were unable to accomplish this feat in twenty-five years of experimentation! Why is there such a discrepancy between the effectiveness of public and private facilities?

A: The approach to fusion used by KMS Industries was entirely different than that practiced in government laboratories. The work of KMS demonstrates the importance of innovation in the private sector and, in general, the value of a diversity of approaches in looking at scientific and technological problems.

C: Both Los Alamos and the Lawrence Laboratories have now achieved successful laser-fusion reactions, and with heavy government funding these laboratories are now outstripping the work done at KMS.

There has been a flurry of concern in the science fiction community over the mistaken notion that the Carter Administration has reduced funding for fusion research. Under the Carter budget, funding was slightly cut from the total originally proposed by the Ford Administration. But the parts of the program that were trimmed were "sidebar" efforts that would create PhD's, not KW's. In general, the Carter budget for fusion appears to be aimed at results, rather than doctoral theses.

Q: Eventually, humankind's coal and fuel supplies will be exhausted, and we will have to turn to the sun and the atom for energy. Should we move ahead on nuclear and solar power sources, and if so under what sort of program?

A: President Carter has sent a comprehensive energy plan to Congress which would increase research and advancement in energy developments, and also allow the United States to depend less on imported oil and more on alternative sources of energy. President Carter has stressed the increased use of solar power, while relying less on the use of nuclear energy. . . .

C: The White House statement went on to quote the President at some length on his energy goals. The comprehensive program that he presented to the Congress has been largely cut to shreds by special interest groups from every sector of our society. The resulting energy "policy" is going to be about as effective as our military buildup prior to World War 2—too little and too late.

Q: Should mass or private transporta-

tion be advanced as the preferred mode of travel for the future?

A: President Carter is in favor of developing mass transit systems, although he is aware that this form of transportation is restricted in some areas. Speaking in Los Angeles, the President said, "There is such a wide range of kinds of communities that it is almost impossible to say what would work in Atlanta would also work in Los Angeles, and vice versa. But I think there is going to be a major thrust of both Federal and state and local government toward a more rapid transit system, each one of which will have to be designed specifically for the community involved."

C: Automobiles are the best form of personal transportation yet invented. They have only two drawbacks: they use a fuel that is rapidly disappearing, and they emit unacceptable amounts of pollutants. Both problems could be solved simultaneously by developing engines that use clean fuels. Daimler-Benz (manufacturers of Mercedes automobiles, trucks and buses) is developing hydrogen-fueled engines in which the hydrogen is stored as hydrides, bound to metallic chips, so that there is almost no free hydrogen in the fuel tanks that can explode and burn.

Q: Should the United States launch a massive effort to draw sustenance and living space from the ocean?

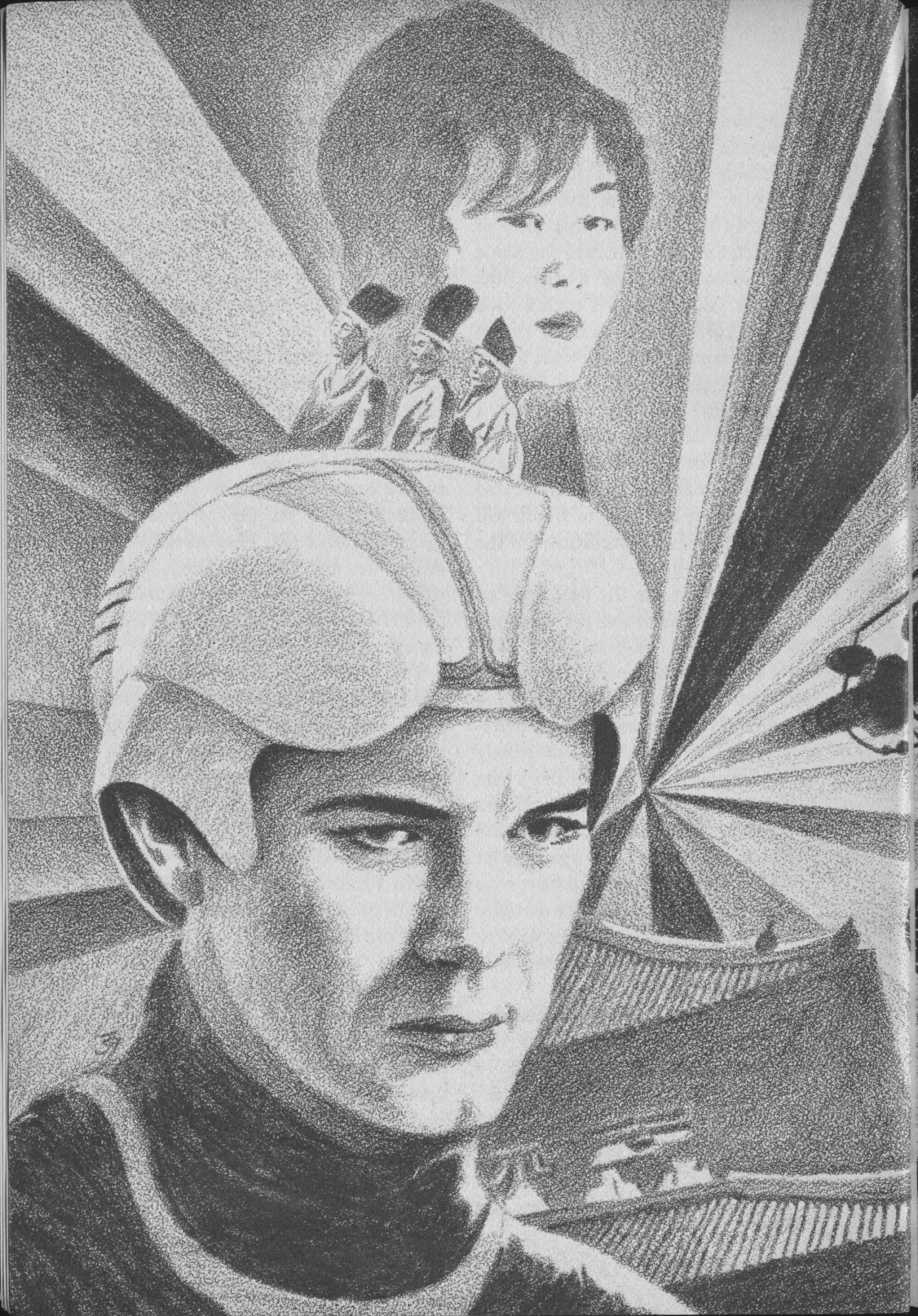
A: The United States is already engaged in a number of programs aimed at increasing our use of the resources of the oceans. These include projects on fisheries, mineral exploitation on the Outer Continental Shelf and seabed, photosynthesis at sea, and bioconversion and ocean thermal energy projects. It is somewhat doubtful whether more would be gained by organizing such individually growing projects into a single "massive effort".

C: There is a time to fund projects with massive amounts of money, but that is only when you have a strictly defined goal firmly in mind, and the hardware prototypes in hand. Until then, a broad program of lower-level support for a variety of research efforts is called for. That seems to be where we are in developing ocean resources—not yet at the "Manhattan Project Apollo" kind of engineering effort.

That concludes Rovin's questions and the White House's answers. But it's not the end of the story. Being tenacious, Rovin also wrote once again to ex-President Ford, and asked if he would be willing to comment on the questions now that he is free of the burdens of the Presidency.

Mr. Ford's executive assistant, Robert E. Barrett, wrote back saying that Mr. Ford would not respond, since his answers "would not deviate materially from those provided by Mr. Ron Nessen."

Since Nessen gave no answers, this has got to be the best stonewalling job since Mr. Ford's predecessor and his staff decided to emulate the Sicilian tradition of *omerta* in regard to Watergate. ■




High technology is as much art as science; it demands a lifetime of devotion . . . at least.
Shipwright
DONALD KINGSBURY
JACK GAUGHAN

I am an arrogant man, he thought. *It was arrogance that brought me out to the Frontier and arrogance that has given me this ironic reward.*

Throughout the Akiran System, from the mines of inmost Sutemi to the cold wastes of outer Kiromasho, farmers and merchants and craftsmen and lords were celebrating with fireworks and dancing. Now the Akirani could forge an empire out here in the Noir Gulf within this thin wisp of stars that pointed Solward. They had their own shipyard. They had their first home-built starship, the Massaki Maru, the First One, the Leader.

I gave it to them.

He stood naked, fresh from the hot pool in the rock garden that mimicked the old wilderness, servants toweling him while two of his children still splashed in the water. His woman Koriru waited patiently for the servants to finish. She had picked out for him a robe of softness, one with black stripes dotted by the crest of the Misubisi. She was a Misubisi. He was not.

For a moment he felt a lonely defiance. He would wear his Engineer's uniform to the celebration, black boots and cling-cloth that protected a man in arctic or desert and, with a helmet, in space. On his chest would be the badge of a shipwright.

I am a Lagerian! The smartest male of the greatest line of engineers in the galaxy.

A burst of white fire exploded in the sky, then turned to red and blue. The blue comets whirled in violent spirals, celebrating his achievement. Somewhere a parade was dancing.

But Lager was 400,000 light days behind him, kilodays by starship, across the Noir Gulf, through a starfog of worlds. He had thrown away his uniform long ago for the soft robes. He remembered kicking it, wiping his feet on it, laughing as he left it. Putting on the Misubisi robe he smiled at that distant elation. It was too late to regret his foolishness. He was not happy, yet he was proud in the sad way a man is proud when he has disproved a cherished theory.

Well, no matter about the Engineer's uniform. He was not of Akira but the Misubisi were all part of him.

Even fierce little Misubisi Koriru was some kind of relative of his. He'd had their women in his hair for a long time. He looked at her in her formal kimono. A ghost of the caucasian peered thru her Akiran face.

"You should be a Plaek instead of a Misubisi," he demanded impulsively.

Koriru bowed. "I respectfully remind you that you did not marry Misubisi Kasumi!"

He smiled inwardly at her seriousness. "But you're related to me."

She bowed again. "All Misubisi know and cherish how they are blooded to the great Engineer Jotar Plaek."

"Do you know your ties?"

"It is of no consequence. I am proud that a small part of me is you. My life is yours."

"What are the ties!" he insisted.

"For not answering immediately,

please pardon me! I am your great granddaughter three times—seven, ten, and forty-one generations back, the last thru Kasumi."

"But of my mad enthusiasm for the machinery of stardrives there is not a trace in you."

Koriru's dark eyes flickered to the floor in embarrassment, showing dark eyelashes. She held her hands in front of her. "My stupidity is inexcusable."

He was inclined to agree. She got mass and charge mixed up and couldn't for the life of her remember whether unlike charges attracted each other and unlike masses repelled each other, or vice versa.

But she nuzzles me in the morning and brags about me to all the powerful people I want to impress so why should I complain? Heredity is strange. Her sister is one of my most brilliant engineers. I suppose I keep her around because I'm lecherous and because she's kind to middle-aged men. She worships me and that makes it easier to be unhappy here out on the Frontier. He smiled at her fondly and sadly. *It won't last. It never does. Koriru will get bored with a man she can't understand. But there will be another. The Misubisi clan takes good care of their Shipwright.*

"Look at me," he said. She half obeyed, not raising her eyes above his chest. "You have the smallness and grace of Kasumi," he mused; Kasumi whom he had loved and treated badly—was that only seven of his kilodays ago? It was amazing that forty-odd generations of Misubisis had lived out their lives since her death. "You are very beautiful."

"Arigato." Koriru again dropped her gaze in the conventionally humble gesture of one receiving a compliment but couldn't resist a flash look into his eyes to see if the compliment was sincere. He caught her at it and, flustered, she turned quickly to the servants. "You may go. Take the children."

The garden was still. She followed behind him along the rocky path in the tiny woods to their house that only seemed fragile.

"Goti!" she spoke the name of the robobutler.

"Hai!" answered that invisible machine.

"Call a robocar."

"Immediately, mistress!"

The Engineer turned away in displeasure. "I don't want to go to that fornicating celebration," he grumbled.

"You must be there. Excuse me for my disrespectful manner of disagreeing with you."

His eyes changed to twinkles. "I'd rather be here caressing your soft hand and gazing into your beautiful face and getting drunk!" He walked over to the liquor wall. "What I want is a bottle of Scotch. All of it."

Of the universe of drinks she feared Scotch the most because she did not understand its origin or flavor or effect. In one swift motion she threw herself between him and the devil. "No! The honor of the Misubisi clan requests that you be sober!"

He glared at her. "I'm no Misubisi!"

She stood her ground, did not lower her eyes. "As faithful servants the Misubisi built *your* ship."

"It's *not* my ship!" He shoved her aside. "It's Misubisi Kasumi's ship!" He reached and took the spherical bottle in his palm.

With one chopping motion she sent the bottle flying to the floor where it shattered. Then she was on her knees, her head touching the floor, apologizing and at the same time explaining the necessity of smashing the bottle.

He was enraged. "Sol's Blazes, I have to distill that stuff myself! It takes two kilodays to age properly!" But she wasn't listening to him; she was too busy apologizing for having done what she had to do, so he picked her up under one arm and clamped his other hand over her mouth. "Goti!" he roared.

"Hai!"

"I order you to spank this wench's bare bottom!"

"It is with abject chagrin that your humble servant informs his lord that he is not equipped to spank."

"Well, there must be some fancy service that you can order to come and do it for you!"

Pause. "My lord, I have been incomprehensibly lax in keeping my records up to date and therefore cannot locate such a necessary service. A thousand pardons."

She bit his hand and he dumped her on a pillow. She was wailing.

"It's all right. I'll go to your space damned party and we'll launch that damn ship and bask in all the glory. But after we get home, I get to spank your bare behind."

She began to smile, having gotten her way, and reached out to polish some dirt from his slippers. "If you do, I'll bite your nose!"

"You wouldn't dare. I'd blow it."

"You're impossible to take care of!"

How much she could look like Kasumi, he thought. It was painful for him to watch the way she held her head in that light with that expression. An ancient tanka of the earthbound Japanese came unbidden to mind.

Deep in the marsh reeds
A bird cries out in sorrow
Piercing the twilight
With its recollection of
Something better forgotten.

He even remembered the poet because it was Kasumi who had given him that poem in final good-bye when remorse had driven him to try to renew their love. One hundred generations ago Ki no Tsurayaki had brushed it onto rice paper back on Earth.

She was hurrying along the street that first night they chanced to meet, the light drizzle as damp as his eyes were now, her light robe soaked and clinging to her in a way no wetproof Lagerian cloth ever would. He simply stared at her. She was the first outworlder he had ever noticed. When she passed by she observed his gaze and smiled at him before she looked away.

"Focus on that trick," he said spell-

bound, nudging his young Engineer friend.

"Exotic!"

"Let's pick her up. It'll save us a trip." They were waiting for a robocar to take them to the Pleasure Basin.

"Maybe she's not horny. This is the business district."

"Tzom!" he exclaimed. "Did you see that smile!"

"She's an outworlder, Jotar!"

"Same race. Women are the same the galaxy over, ready to go nova at the flick of a neutron. They know a good stud when they see one. How could she do better than us? She knows what an Engineer is by now. Look at yourself in a mirror sometime, joker. You didn't get to be where you are by being a weakling. And besides, I want to do the picking for once." Their robocar had arrived, enveloping them. "Follow that woman," Jotar commanded.

The friend was disturbed by this extreme aggressiveness. "There's two of us," he protested.

"That'll make her wheels go round twice as fast. She'll love it." He leered.

"Women like subtle men."

"Grumble, grumble, grumble." The robocar slid to a stop, cutting off the raven-haired exotic but stopping short of enveloping her. Jotar smiled his smile which had been known to send the bank account of a woman flickering in the last two digits. "We've fallen in love with you," he said.

She looked at them without comprehension and her hand went to the hilt of a dagger in her wide belt.

"That's a dagger," whispered Jotar's friend with urgency.

"Perhaps you don't speak Anglish?" added Jotar hastily.

"Excuse myself for speak your language poorly. I hear barbarous intent. I certain I am mistake." Gently she began to edge around them.

"Our intent was to offer ourselves to you for an entire evening of pleasure. Any way you like it."

Her eyes narrowed. She glanced about for possible escape routes, computing the swiftness of the robocar, then looked Jotar in the eyes with great poise and some small trembling. "It would be small pleasure for you rape one as homely as me. Not beautiful at all."

Jotar was taken aback. It wasn't her self-effacement that surprised him, it was her choice of thrill. On a grade F solidio once smuggled into the Monastery when he was a student he had seen an implausible story about a girl who liked to be raped—but he had never heard of such a thing in real life. Maybe they were pretty odd out there among the outworlds. How would he know? "We're pretty good at rape," he said, nudging his friend, and faking a menacing look. Anything to please such a lovely woman. "And I think you are *very* beautiful."

"I struggle hard." She was paling. "I bite."

"Oh, that's no problem. We can hold you down so you can't do any damage," he said, trying to get into her fantasy.

"Please not to harm me."

Jotar smiled broadly. "Harming you would be letting art get out of hand, of course, of course. No bruises. Get in; I know just the place to take you."

She fled, dagger in hand—a short run, then a leap down a staired passage where the robocar could not follow. They watched her disappear into the forested ground floor of a soaring hotel, her graceful stride a composite of motions unknown on Lager.

Tzom turned on Jotar. "I told you; I told you! You'll never get anywhere that way! You have to entice *them* to approach *you*."

"Yeah, yeah." Jotar stared after the lost beauty absently, a remarkable emotion of infatuation puzzling him. "I didn't follow her script."

"You dummy. It was because you overdid it. You've got to remember how women think. They've got to be in control. If a woman wants to be raped, you can't just rape her. You have to be subtle. She has to provoke being raped or she's not going to enjoy it. Everybody knows that about women but you, dummy!"

"Yeah, yeah. I guess it is the Pleasure Basin for us."

They instructed the robocar to take them to the village of dim bawdy houses and terraced restaurants and gaiety.

"How about dancing?"

"Naw," said Jotar, "I'm shorted-out tonight. How about just touring the cafes and getting picked up?"

"Too dull," complained Tzom. "I'd rather get auctioned off at a dance. Get into some clothes flashier than this uniform. Get a sweat up."

"Yeah, but at an auction you have to take who you get. That can be all right except that I'm not in the mood. In a cafe there are easier ways to say no. Go ahead, I'll see you in the morning."

"No, no. We're together tonight."

No youth who entered one of the Engineering Orders stayed a celibate Monk—he either mastered the rigorous mental and physical training and graduated into the ranks of the Engineers or he failed and became a Technician and married if a woman proposed to him. The Engineers were forbidden to marry lest a hereditary caste develop and so an Engineer's name died with him. But not his genes.

All over the planet there were places of rendezvous where any woman might go to meet those men who were the physical cream of the planet and have her sexiest fantasy made real. No matter that she was a simple data clerk, or ugly, or old, the Engineers were hers to buy for an evening of pleasure. Only one out of every thousand citizens of Lager became an Engineer but eight percent of all the children born were seeded by Engineers. And engineering talent abounded on Lager and Lager made its name throughout the human galaxy with its engineering marvels.

The robocar let them off at a cafe called the Lion's Loins. Real male lions greeted you with a snarl at the door.

But they were lazy. It was the lioness who pounced from her perch above the door that startled unsuspecting clients. Sometimes a menacing lion or two would grab a shy woman by the wrist and herd her over to an Engineer who would chase the lions away after a mock battle. The animals had computer implants, of course.

There was a central lighted bar which acted as a focus because it was the only place where drinks and food were served. The women could appraise a man here before deciding to approach him. Surrounding the bar were dark junglelike alcoves where privacy was at a premium if you weren't upset by an occasional sniffing lion.

"You'll never guess who picked me up the last time I was here," said Jotar grinning.

"Is she here tonight?"

"No, no. Gail Katalina." Katalina was the Third Director of all Lager.

"You're pulling my ear! What's she like?"

"We ended up spending a ten-day together on her yacht. She keeps herself in good condition for her age. She's always busy. It was like being plugged into a thousand volt line."

"I hear she's kinky."

"Naw. You know gossip. She resonates on photography, that's all. She's a good lay. I felt my innocence, but she wanted to keep me. She was going to set me up in Dronau Hills."

"And you said no?"

"I'm busy."

"You're a brave man to turn down that kind of political connection."

"Come on, Tzom, power is warming but it doesn't rub off. You know that. Once you believe it does, and start chasing powerful people, you end up as a moon, and if you get too close you end up as part of their mass. What do you want to drink?"

Jotar was acutely aware of the women around him. He had to be; Tzom never paid attention until a woman spoke to him and by then it was often too late to control what was happening. One dazzler with bare shoulders stared at him from across the bar. He smiled at her but she turned away and he knew he wasn't going to attract her.

Once they had their drinks he settled on a lady with twinkling eyes who looked like she had had enough of a past to be interesting. She was with a young girl, probably her daughter from the facial resemblance, perfect for Tzom. He smiled at the woman with extra warmth when her eye caught his, and winked at the daughter.

But his mind hardly took the flirtation seriously. While he followed Tzom to a table his imagination put him in the villa of some outworld where his robed stranger was expected. This time he would take her arm gently and be careful not to frighten her.

Their table was equipped with a monitor which, when switched on, indicated to a woman that they were free and allowed any woman to view them and listen to their conversation

from the privacy of her table. The two Engineers kept their conversation simple. Jotar's attention wandered.

In the semi-light one distant face seemed to be his mother and he lingered on it for a moment—his beloved, brilliant, crazy, naive mother who had met his genetic father in a place like this and had foolishly preserved her love for him in some corner of her mind beyond reality. She had illusions about the beauty and luxury of an Engineer's life based on one ten day experience. In real life she was a Gardener who was responsible for the ecology of 3000 hectares of land in the Miner's Hills and mother of four children, two of them by her husband. Jotar's only sister was also the daughter of an Engineer.

It was his mother who had decided that he was to become a shipwright. He remembered. When he was not yet two kilodays old she'd taken him for a night hike in the hills and they had slept on the grass beneath the brilliant stars.

"*People* build ships to go to the stars," she said cuddling him in the sleeping bag. She fastened electronic binoculars on her eyes and slave goggles on his. "See that bright one there?" Cross hairs appeared and disappeared. "That's Gosang. We trade with Gosang in ships we build. See that tiny one there?" The cross hairs reappeared briefly. "Just above Gosang? That's Al Kiladah 43, so far away that no ship yet built has ever reached it. Even though they appear close to each other in the sky, stars may be far apart in space. Someday someone will build a ship that will reach Al Kiladah 43."

"Could I do it?"

"If you became an Engineer."

"Why can't we go there now?" he asked.

She explained to him the problems of the kalmakovian drive in terms a child could understand. "If a starship travels at 200 light speeds, the machinery ages 200 times as fast as normal to fool the gods into thinking it is traveling slower than light so they won't get upset about one of their laws being violated. In fast-time the machinery wears out if you go very far. Engineers have to make it very very reliable. If *you* aged as fast as a starship, you'd be grown up in thirty days."

"Then I would be old enough to run away from home before I'm old enough!"

"Where would you run to?"

"Al Kiladah 43!"

"Oh my. That's far away. I don't think you know how slow 200 light speeds is, young man."

"Some more stars!" he said. "Show me the farthest one we've reached!"

"Hmm." His mother talked to the binoculars and symbols began flashing across the goggles. "Well, I can show you *one* of the farthest." It took her awhile to find Akira. "It's on the Frontier."

"Who went there?"

She smiled. "I don't know. Our binoculars are very stupid. Not much memory."

"Turn up the power and we'll see them!"

"That's a tall order for ten credit binoculars. We wouldn't see them anyway. We'd see Akira before men got there."

"I'll build some good binoculars when I grow up."

"Would you like to be an Engineer?"

"Yes."

"Would you like to build ships? Would you like to build the greatest ship that has ever traveled space?" Her words were more of an order than a question.

She began buying him models of ships to build. He got a modular computer for his birthday and every birthday thereafter it became larger. Its memory eventually held the best private collection of starship materials on Lager. Just to manage the horde of data his mother bought for him obsessively, Jotar eventually developed a cross-indexing system unique in starship design history.

Since physical agility was as strong a criterion for graduation from an Engineering Order as intellectual ability, his mother saw to it that he went to dance school. They were country people looking after forest and grasslands and the nearest dance group was 160 kilometers away but she shuttled him there regularly. She overlooked nothing. Most children could play tag with their robogoverness—Jotar's played mathematical games with him.

Sometimes he had to escape from his mother. He'd put on his waldo leggings and jump across the hill meadows with 20 meter leaps pretending he was on a light gravity planet, or he'd leap to the tops of trees and be an animal. Even then he couldn't always escape her. He'd be pursued by thoughts about stardrives.

Before he entered the Black Horse Monastery, before he was full grown he already knew what mankind's greatest starship would be like.

Jotar finished his drink. He knew exactly how long it took a woman with a gleam in her eye to make up her mind. Then he ambled back to the bar. It did not surprise him that the lady and her daughter also chose that moment to refill their glasses.

"Would you care to join our table?"

"Delighted," he said.

Tzom never knew why the handsomest women always invited them when he was with Jotar.

They chatted together over a second drink. The daughter had been recently married and was being educated into the wilder side of city night life by her flirtatious mother. The girl hovered between fascination and shyness while the mother decided where to take them to dinner and when they were going to retire for more serious amusement. Two lions blocked their way as they tried to leave. Jotar made the mistake of kicking one of them, and was slapped to the ground. The lioness stood on his chest and licked his face.

"Do you need help?" asked the girl.

"Damn animal show," he said.

Jotar got stuck with the young one. He never let his boredom show: it would have been unprofessional. They went to his apartment and he tried to please her. He let her hold him after their lovemaking while she drowsed, though he was inclined to push her away. To pass the time he thought of his crazy mother's illusions about the life of an Engineer.

She at least had a conscientious husband, a tolerant man who had created a stable home life for his children and generally ignored his woman's waywardness or at least seldom spoke of it. He would just shrug and say, almost with a smile when their mother disappeared for days at a time, "Women have more lust than men." She had the luxury of knowing her husband and sharing with him in a way that is only possible after long contact.

Damn. Jotar couldn't even remember the name of the girl who had picked him up last night. And a week ago he'd been to a pre-wedding party given by the bridesmaids, and the bride and five bridesmaids had had him, one after the other between drink and lavish food and fun—and he couldn't even remember their faces.

It was something he could get angry about. Like he was angry right now at this girl with her legs around him. She'd get pregnant. She'd tell her husband and they'd celebrate. *But she'll never bother to tell me.* Not a chance. *Sol's Blazes, it makes me angry!* He was human. He liked children. He'd cherished his younger brothers and sister. Probably he had seeded thirty children already but he'd never know. They used you and they never came back.

I'll never hold a tiny baby in my arms. The tears were running down his cheeks in the dark and he was furious at his bed partner but he caressed her tenderly. *Little baby girl.*

When she finally went to sleep, he displaced her arm, slowly, carefully, and sneaked out of bed to his workroom. Without really being aware that an earlier meeting was on his mind, he sketched the outworld woman's robe onto the surface of the workroom's computer terminal, rotating and modifying it, until it matched his memory. Then he sketched the peculiar racial characteristics of her exotic face. While he worked, he smiled, wondering what it would be like to be loved by an outworld woman, pleased to know already that she was not like Lagerian women.

He put the computer into its pattern recognition mode. It overprinted his drawings from time to time, asking for clarifying lines, details. It paused for one hundred seconds before burping out a list of probable worlds. All of them, it turned out, belonged to a class of solar systems which could be traced back to the ancient Japanese race of Terra through a philosophy called the Mishima tradition that placed strong emphasis on old values and had advocated going into space to preserve them.

Jotar spliced the list into the immigration and trade records for an intersection-sort. Only one group matched the available data: a trade mission from Akira, an obscure Frontier sun. They were here to buy heavy automatic machinery and starships. Such a trade mission did not make much sense—Akira was too far away for direct trade.

A detailed examination of the papers of the trade mission members gave Jotar what he wanted. The beautiful flower who had dominated his senses was called Misubisi Kasumi and she was the mission linguist.

Elated, he went back to bed, kissing his companion's rump out of happiness. He did not go to sleep. He began to plot the seduction of Kasumi by organizing all the available facts. The central fact was that if they needed starships, he was the galaxy's greatest shipwright. The second fact was that she alone of the mission spoke Anglish.

A week of feverish work went by while he prepared and perfected his plan. Like all good plans it solved two problems at once, allowing him to build man's greatest starship *and* to have a steady lover who excited him.

Engineer Jotar Plaek had yet to build a single ship. He was young, too brilliant to ignore and too brilliant to use. He was proposing a radical restructuring of the kalmakovian field guides that scrapped ten generations of engineering experience. He had solved the new field equations and shown theoretically that structures of positive mass and negative mass could be fabricated into the required guides with impressive inertia-low characteristics. Accelerations of one light speed per ten seconds were feasible, unheard of performance for the best of modern drives. Final velocity would only be ten percent greater than with a regular drive, but that figure was calculated by making enormously conservative estimates of every parameter. Jotar suspected that velocities of one thousand light speeds might eventually be squeezed out of the design, where 250 light speeds was the theoretical maximum for the orthodox guide configuration.

He was so brilliant that he had never been able to find a sponsor. He had papers and credits and consultations and lecture tours that would honor an older man—but no hardware to his name. He knew some of the best Engineers personally but had few contacts in the government except for Gail Katalina, the Third Director, and most dynamic member of the Directorate. As he remembered her, she was delighted to be seen with young men but had no interest in starships. In spite of his boasting, she probably didn't remember him.

So his plan was to bypass Lager and let Akira sponsor the research.

He sent out a feeler to the Akiran mission—terse. He knew they would check his credentials and when they found him to be the most knowlegeable shipwright of Lager, they'd come to him.

Misubisi Kasumi came.

She did not recognize him. He supposed that all Lagerians looked alike to her. They talked business. He spent the whole morning with her at a projection table showing her details of the ship he wanted to build for them.

The table could do anything. It could enlarge or contract the diagrams in its memory, or give you a cross section through any angle. If you wanted iron in red and copper in green it would give you that and blot out all else. If you wanted bulkheads, or wiring, or plumbing, it would give you all of those separately. It would give you parts and explode them. It could show you the kalmakovian drive and the field changes as color changes when the drive was "operative". It could run standard simulated voyages that put every part through an extreme test.

Jotar had spent all of his time as a Monk building the plans for this vessel. It was the completed project which gave him Engineer status. He had spent all of his time as an Engineer revising details and trying to sell it to a sponsor.

In all of the galaxy only on Lager was such a monumental one-man project possible. There were myriad computer routines on tap to design almost anything to any reasonable specifications with fabrication cost optimization and maintenance optimization. If he wanted docking gear, a command would generate it.

Where the computers failed he could use the Monks by assigning a project. They enjoyed such projects because they received much credit for solving problems beyond the capacity of the computers. Sometimes he used other Engineers as consultants. It was the drive unit that was uniquely his.

"How fast?" she asked.

"Do you need a fast drive?"

"Yes. We isolated. We live across the Noir Gulf." She paused.

"Never heard of it."

"It is like cosmic moat across the Sagittarian route to the center of the galaxy. It is one of the great gravitic divides. At narrowest between Znark Vasun and Akira, it has width 175 leagues. At other places it has width five hundred leagues. It has slowed human expansion in that direction. Akira is double isolated. We exist tip of stellar wisp called the Finger Pointing Solward. We can trade with Znark Vasun—long trip. But if we go up, down or sideways—nothing. Gulf. We go down Finger toward galactic center–all Frontier, little trade. In future, when all developed, still we be trading along straight line of stars." She gestured negatively. "Much more expensive than trading in volume of stars. We need speed."

"I can't guarantee it on the first vessel but the speed potential is there. A thousand light speeds."

She gasped. "We want that. Explain me your drive."

"It's not mine. It is just a modified kalmakovian. You know the sort of thing—the difference between propellers and jets. I'll show you the differences." He began to put images on the table's screen.

"I am so sorry for my inexcusable

ignorance but I not understand physics. There is positive mass that goes down and negative mass that goes up, there are kalmakovs and einsteins and widgets. And momentum and energy are both composed of mass and velocity but they are different. I never understand."

The kalmakovian effect is the converse of the einsteinian effect.

In einsteinian flight an external energy source like a rocket increases the mass of the ship and time slows for the occupants. They can go to a star and back within months of their life and so consider an einsteinian rocket as a "faster-than-light" drive. It is for them. To the people back on the home planet who have lived by a faster time, the einsteinian rocket has never exceeded the velocity of light.

A kalmakovian drive turns a ship into a "falling stone" without an external field to attract it. It can accelerate at thousands of gravities while still in free fall. It uses no obvious energy any more than a falling stone uses energy because it taps into the greatest source of energy available to a ship, the potential energy called the ship's mass. It converts rest mass into velocity. Because the rest mass of every atom in the ship decreases while the drive is on, time accelerates relative to those worlds outside of the field. And because time accelerates for the occupants of the field, it always seems to them that they are traveling below the speed of light. But to the people back on the home planet the journey took only a matter of months and so they consider a kalmakovian ship as a "faster-than-light" drive.

In the early days of starflight shipwrights learned to protect their passengers from this kalmakovian "starship aging" by using related field phenomena to displace some of the rest mass, ordinarily converted into velocity, to the mass field of special slow-time cabins for the passengers.

Deceleration is no problem. When the kalmakovian field collapses, velocity is automatically reconverted to rest mass and the ship stops at rest relative to its starting coordinates. The photon rocket motors on each starship were only used to compensate for the relative velocity differences between departure star and destination star.

"Well," said Jotar, "send your technical expert to me and I'll explain it to him."

"You said you wanted our sponsorship. Excuse me for not understanding."

"You're in the market for ships. I've seen your specs. You want the best. This is the best. If you buy my ships I'll build them for you. If you give me an order for twenty, I'll give you a price comparable to anything else being built. That's what I mean by sponsoring. I need your money."

She looked doubtful.

"You're used to going to a bureaucrat and ordering something that you can already see being assembled up there in some shipyard—the thousandth edition of a standard vessel. You can do that but you won't get the best."

"Honorable Engineer, you are not dealing with ordinary planet. You are dealing with very humble planet of meager resources."

"But not poor because you are lazy or poor because you breed planlessly, but because you are Frontier and isolated. Your people are ambitious and hardworking."

"Yes."

"The best kind to deal with. I'll tell you what. I'll give you a bargain. I'll throw in the ship's plans."

He could see her tremble with excitement. He wasn't going to tell her how useless those plans would be to her people. They were keyed to an inplace industrial plant, a pyramid of crafts and skills that a Frontier planet couldn't hope to duplicate in less than sixty kilodays. Jotar doubted that there were more than ten worlds in the human ecumen that could build from those plans.

"Why you need us? A day's trading on Lager would buy all planets of Akira."

If only I could explain. He sighed. "Getting something done is not easy. It never was for geniuses like me." He tried to think of an analogy to give her and fell back on pre-space Terran history. It was humankind's common background, times and people and clashes that every civilized man related to. "I could have sold aircraft carriers to the Japanese Navy in 1925 AD; I doubt that I could have sold flying bombers to the United States Army Air Force in 1925 AD."

She laughed.

"Here. I feel like a snack." He took her away from the table and sat her down on pillows. "I dug up a bottle of rice wine just for you." And he poured her a glass.

"Do you drink rice wine?" she asked in surprise.

"Never touched it before in my life."

"It is my shame that I have never either." She spoke with sadness.

He produced a plate of delicacies—cauliflower with mayonnaise and vinegar, a tofu and tomato aspic, roast peppers which weren't peppers at all but a plant from a world called Tekizei, and raw fish.

"What is this?" she said tasting it with her fingers.

"You've never had raw fish? I took it from an Akiran recipe book."

"Raw fish on a space ship? I am so sorry but you are out of your mind."

"What are you familiar with?"

"Hard tack." She laughed.

"I see." He paused, reflecting upon the tales of Frontier hardship. "What's Akira like?"

"Ohonshu, the major planet, not need to be terraformed. The plants are *pink*—oh not really, but pink on their bellies. They flower on the ends of the leaves and the seeds form in leaf stem. Terran life not thrive well in wild, except for grass. We have tiny wild horses, real horses. Terran birds have done well, I not know why. The colonists were mostly bushido fanatics, caught in the mysteries of a religion their parents not understand and their children not really understand

either. They left us strange and beautiful monasteries. It took fanatics to cross the Noir Gulf. They were good people. But I not remember it much. We left when I was small. The captain is my father. My mother not come. It's far away. Living on planets seems strange to me."

"Has being planet bound frightened you?"

"Yes! Oh yes!"

"Eat your raw fish."

"Do you like the rice wine?"

"Oh yes. Sake is in my genes."

He was happy. "You are a pleasant person to be with," he said trying to draw her into a commitment without being as direct as he was inclined to be.

In response she merely lowered her eyelashes.

It exasperated him. How by the fire of a sun's blazes was he supposed to handle a mannish woman? He paused, then tried again, gently. "Have you been outside of the city?"

"No. But like to. Lager seemed so lush from space!"

"You must have been looking at my parent's place. It is beautiful country. Once you are free of the main burden of your work we could visit them and take a hike along the river. A hundred kilometer walk. You'd love it."

"A hundred kilometer walk would be therapeutic for my soul, but rubber space legs would protest."

"I'll give you waldo leggings. We'll camp out."

The next day he saw Kasumi again. She brought him a small present of dried fruit. He held her at arms length, looking, smiling. It was good to see the same woman twice.

The next ten days were hectic. Between catnaps, he worked endlessly with the Akiran mission, ironing out the details. They signed a contract. The news spread like a nuclear excursion: Jotar Plaek was going to build his crazy ship. Those were good days.

He found it easy to be with Kasumi, anticipating her grace when he was away from her and marveling in it when she came to him. There was something exquisite about just letting things happen, not investing energy into making them happen. He was good for her. Unobtrusively encouraging her initiative, he brought out a hidden boldness and confidence. Once when they were eating together in a cafe, she struck up a conversation with an Engineer at the next table and took him with her for the rest of the afternoon, letting Jotar fend for himself. Jotar was pleased that because of him she had become more of a woman than she'd even been before in her life. When he was most content he would think that it was a good thing for Lager that they all pumped the blood of their mothers; he imagined Lager as a very quiet Eden with its Eveless men waiting for the apples to fall before they ate.

One day Kasumi was swimming nude at a river bend. She came to him and asked him to towel her off. He smiled at her. She smiled at him. Each felt aroused. Each refused to make the first move. It was like being a Techni-

cian. Love. A woman. Contentment. No worries. He took her to the meadow where he had first seen Akira and finally their chemistry drove them to become lovers. They whispered sweet nothings all night and licked at the dew in the morning with their tongues.

When the dew had melted but the grass was still rosily lit, she recited a poem by Akihito from the almost sacred Manyoshu.

"I was wandering
Among flowered spring meadows
To pick violets
And enjoyed myself so much
I slept in the field all night."

The work orders went out, financed by Akiran funds. Countermanding orders were issued by the government's APCT and Jotar flew to the capital to straighten out an administrative mess caused by some lunkhead who couldn't understand an outworld investment in a project which had been turned down by the Lagerian Aerospace Technical Oversee. He got through the fracas by a compromise which required him to hire a watchdog staff to prevent the leakage of Classified Skill and Craft Forms. LATO then issued a Duty Liaison requiring computer-filed abstracts of all progress down to the Work Action Order level.

Within four days of assembling the new staff a minor Liaison Engineer panicked at the new methods of manipulating positive and negative mass fabrications and the project was temporarily halted—Injuncted for a Retro Study. That lasted twelve days. Jotar managed a Reactivation Order but the renewed research had to be transferred to deep space where facilities weren't equipped to handle it. Jotar spent forty days building a new space factory.

Then they ran into real fabrication problems which no simulation could have anticipated. Each glitch was solved but every solution seemed to generate new troubles which had no obvious source. Jotar found to his horror that he wasn't a hardware man. He brought in consultants and that cost money.

Finally some key parts arrived for the drive assembly but they had been fabricated to normal starship specifications which weren't good enough in the new configuration. Jotar sued and was countersued. He won the case but was sued from another quarter for nonpayment because he had neglected to transfer funds, and, alarmed, the government froze funds to cover work orders which had as yet not been issued. He hired lawyers. They sent him a bill.

In 200 days Jotar had gone through all of his Akiran capital.He had promised twenty ships. Not one was remotely finished. In desperation he turned to sex. He didn't think that Third Director Gail Katalina would even remember him, considering her reputation, but he was wrong. She returned his call within two kilosecs.

"Of course I remember you! You're the Engineer with the most beautiful eyelashes on Lager! I'll send an execu-

tive plan for you. Can you pack today? I'll meet you at the Jongleur Gardens. My husband won't be there. I may be late, but that will give you time to make yourself beautiful."

The executive cruiser was prompt and polite and like all high level government roboplanes did not take orders from the passengers. It had been instructed to fly the scenic route through the Lebanor Pass which it did—skimming the mountains' treetops at a speed never less than 500 meters per second. Jotar kept swallowing his heart.

For all that haste he arrived at the Jongleur mansion to find himself alone. He was put up in the master bedroom with a wooden fire blazing. He was fed delicious food by invisible robocooks and told not to wear his uniform by an invisible robovalet who provided him with lavish clothes of a cut which might be worn on stage but never in public. He swam. He read. He tried on clothes and practiced entrances and lines and charm. That night he slept alone.

Director Katalina arrived late the next afternoon. Her hair was white. Her face was lined by the act of smiling so many times at the victories of her ruthless rise. She hugged Jotar, pinched his bottom and handed him her briefcase. Her two female executive secretaries followed closely to stay inside the shadow of her power.

At dinner she had a videophone beside her wine and continuously interrupted their trivial conversation by answering calls that came in to command her attention. She'd be kidding him about the time he fell overboard on the yacht and switch into an animated discussion with some disembodied voice concerning the credit rating of the Amar Floating Peoples who did not qualify as a solar system, and as quickly come back to comment on the bouquet of the wine.

Once Jotar made the mistake of letting the conversation wander around to the subject of starships. She gazed at him with true adoration while he spoke, so he spoke with increasing fire and clarity.

She cut in. "Your intelligence makes you *so sexy* I can't stand it anymore!" And with that thought she pulled him off to the bedroom where she called up her secretaries, instructing them to handle all incoming communication.

First she undressed Jotar. Then she posed him for inspiration. Then she took out her paints and began to decorate his body while he watched in the mirror-screen. Whenever she asked for his advice he praised her. His ear itched.

She became so enthusiastic about her masterpiece that she called in her secretaries to help photograph him for her collection. They took endless photographs, developing them with different dyes, cutting, distorting, reposing him. He was pleased that she was pleased.

Once her assistants were dismissed, Director Katalina had him carry her to the bed. "Do you remember how I like it, you big beautiful rascal?"

He did. By morning he was suffering a bad attack of anxiety. He had done everything conceivable to please her and she had never given him an opening. In desperation he decided to serve her breakfast in bed. He knew a recipe he was sure the robocooks didn't know because Kasumi had taught it to him, but he got caught in the kitchen by one of the secretaries who hadn't bothered to robe herself.

"Hi, big boy."

"Hi."

She began to fondle him.

"Look, I'm just trying to get some breakfast for her."

The secretary spoke some commands. "Let the robocook do it. I'd like to have you for a moment. I'm much younger than she is."

"The robocook isn't up to this particular dish."

"You don't understand, boy. I'm her *executive* secretary. Everything she acts on goes through *my* hands. You have to please me, too."

"I don't think she'd like that." He didn't dare remove the executive hands from his belly.

"She'll never know a thing, pretty boy. It'll only take us half a kilosec."

He got back to the kitchen while the just prepared breakfast was still hot, and carried it up to the Third Director, cursing the robocook and the secretary. The old woman smiled at him. She pulled him down and kissed him.

"You want something, don't you? What is it?"

Oh thank Newton! He sat down on the bed and composed himself.

"It's about your starship project, isn't it? You're broke. See, I know everything. You want money to continue. Money, money, money—that's all an Engineer ever thinks of."

"Sometimes," he said.

"What makes you think I'll give it to you?"

"All I wanted to tell you was that my starship is important to Lager."

She laughed. "We sell every starship we can make. Your venture isn't important for Lager, it is important for you."

Well, I tried.

She laughed at his misery. "You fool! What would I be if I couldn't do favors? Don't worry. I'll handle everything. It will be all right."

He made love to her in gratitude and she enjoyed his total giving of himself.

Back at his central office, he waited three days. The government put him in bankruptcy to save him from the responsibility for his mistakes. They took over the project of building his ship. The sudden loss of control shocked him: he had an office but no command lines. His faith in the power of sex was shaken.

Then Kasumi timorously announced that she was pregnant.

Jotar did his best to get the State to take over his debt to Akira but the reorganized project refused to underwrite Akiran interests. With that blow Kasumi's father and three of his closest associates committed suicide.

Kasumi called. Jotar refused to see

her. He wanted to see her but he couldn't face her. He began to drink heavily. He disconnected his communicator. Finally he put his furniture and library in storage and disappeared. Nobody knew where he was because he was on an island beachcoming with a woman who had run away from her husband but would probably go back to him when her money ran out. They had met at a cafe in the Pleasure Basin and she had coaxed him into chucking it all with her.

One day while this woman helped him carve out an outrigger, the roasting sun at their naked backs, he told her about building the galaxy's greatest space canoe, a tale he embellished with truth, lies, puns, and emotion. The idea seemed hilarious to him, a fantasy laid on him by his mother when he was too young to reject it. The trouble was he wasn't *sure* it was a fantasy. Then for months he didn't think at all. He speared fish.

His woman left him, having learned more about canoes than she wanted to know. He drifted and another woman picked him up. Lusena was a distortion photographer who took pictures and fed them into a special computer. He was fascinated. By playing with the commands and selecting out only those image distortions that caused an emotional resonance the photograph evolved in color and pattern until it became a setting from one's private dream world. Jotar showed Lusena's art to everyone, raving about it for kilosecs. Lusena had a haunting dream world. All that came out when Jotar tried it were pictures of grotesque pinheaded women or elabyrinth long starships that faded complexly into the sky. Time passed.

Jotar was being supported by two waitresses from a local pub in their houseboat when his sister found him. Brother and sister, each seeded by a different Engineer, fought for days. They ranted themselves into a good mood by sunset whereupon he'd cook the three women a sumptuous meal, stews boiled in beer, beer cakes, beered chicken casserole, and the four of them would reminisce about childhood during the cool of the evening. In the morning the fight would start again.

She sneered at his unwillingness to drive ahead against all obstacles. She derided him for being ruled by the considerations of inferiors. She described what they were doing to his ship in his absence. She flattered his genius for seeing the piece of the puzzle that escaped all other eyes. She goaded his pride. She won. He went back to work.

When he returned to the project he was astounded that he was still respected. Genius had its prerogatives. He was astonished that he still believed in his ship with an insane passion. He worked hard. The ship had what he'd always wanted—government sponsorship. He was now willing to be humble when they told him that the fabrication problems needed research and time.

Half a kiloday passed before he realized that, even working, he had no

control over the drift of the project. A whole kiloday passed before he saw the trend of the drift.

The project Engineers were solving problems creating solutions closer to something they already knew. As the total solution began to emerge, Jotar panicked. He ran in seven directions trying to trace down the individual decisions. He got passed from Engineer to Engineer to Craft Guild to Economist to Production Manager to Beer Hall.

Finally Keithe Walden took him hunting. Walden was the man in charge since the bankruptcy, an older Engineer, jowls sagging. He could make ten thousand men play choo-choo train in unison. They had it out in a duck blind with bugs buzzing around their heads.

"Keithe, I think you're full of meadow-muffins."

"Jotar, if you were redesigning a woman, you'd take off the breasts for streamlining . . ."

"Would I!"

"You'd take out the kidneys because they smell. You'd . . ."

"Now look! I like women the way they are!"

"No you don't. You'd have a thousand improvements if you thought about the problem for a kilosec. What changes would you make?"

"They'd be practical changes. I'd put in a servomechanism so that a woman could control her ovulation. Shreinhart showed that the immunological system could be vastly improved if it had better data processing capabilities. There's no reason bones should break or get brittle with age—there are much better materials. I think it is shocking that, kilogram for kilogram, solid state devices have more storage and logic capacity than neural tissue. How about an electromagnetic sense? And women certainly should have a penis to piss with."

"You could go on and on, couldn't you?"

"Probably."

"That's what I mean. Then you'd start to fool with the genes so this new woman could reproduce herself—and you'd be in big trouble because of the incredible cross-correlative interdependence of the genetic interaction. Evolution is a slow thing. You can only change marginal things in something as complicated as a woman or a starship—and each change has to be proved out over generations before you can make the next incremental change. A man has 98% of the genes of a chimpanzee, remember that. You want too much change, too soon. You have to start with what you have."

"I'll give you a herd of horses," said Jotar, "and you can start breeding me a flock of birds out of them."

Jotar took up billiards and poker. He danced and wenched. He spent long days playing with his sister's children. Walden built a prototype ship and took orders for five hundred. It hit the news. LATO called it Jotar Plaek's ship and said it was the greatest starship ever launched.

Yeah. We changed the brass doorknobs to silver.

Two days later Misubisi Kasumi followed him home to his apartment. He didn't notice her until he went to close the door. A small girl was clinging to her leg. "Here is daughter you abandoned," she said bitterly.

Shock. "Hi." He went down on his knees but the child turned her face away in shyness.

Kasumi disciplined the child. She held her face toward Jotar. "You must see mean father who abandoned you."

Tears were running down Jotar's face. She was the first woman who had ever brought one of his children to see him. He was touched beyond anything that had ever happened to him.

"A beautiful kid. Your side of the family. Kasumi, come in. I'm sorry about it all. I got caught up in my own madness. I was destroyed like everybody else."

She marched into the richly furnished apartment, gripping the child's hand. "You seem to be doing quite well."

"I manage."

"You built your ship."

"It's not mine. They changed the grille. It comes in new colors."

"That's good enough for me. Take an order for twenty red ones."

"Sol's Blazes! I wish I owned one to give you! Nothing's mine! I control nothing!"

"You ruined us!" she screamed.

"Yeah, yeah. I ruined you. I won a lot by doing that. How have you made out? Do you still have your ship?"

"Yes."

"Thank Space for small blessings. Why are you still here on this fossilized world when you could be out on the Frontier where people are still alive!"

"The mission must bring back something."

"Have a shot of whiskey. I've got no sake. Some milk for the kid?"

"No thank you."

"So what are you going to take back that you can fill your holds with for free?"

"Knowledge."

"It's a good cargo. They don't sell it for free here."

"Since you left me I have had relationships with many of your Engineers." Her voice flowed like a starlight-stirred wind of helium on a sunless planet. "Each has given me something out of pity. I have enough to build industrial empire. I want you to give me everything you know about starships. You owe it to me."

"I'll give you my head in a pickle jar."

"Don't offend me. I hate you enough to kill you!"

"Sit down. I'm on your side. I'm ashamed. Let me think of the resources I do have." He paused. "I collected a fantastic library when I was a child. I'll give it to you. I'll give you the original plans of my ship." He laughed. "I'll give you the plans for that flying toilet bowl they built in my name. But," he slammed out with careful enunciation, "*it won't do you any good*. Knowledge is only valuable if it can be activated. What can you do

with a riddle you don't ken?"

"My people are brilliant."

"I'm brilliant," said Jotar angered. "If I hadn't grown up on Lager I'd know nothing about starships! Nothing! I could wallow in every computer memory about starships that has ever been recorded and I'd learn nothing!"

She glared at him with hatred.

"I'm not arguing with you. I'll give you all I can. Thank you for bringing my daughter." Impulsively he brought out a toy he'd bought for his sister's youngest. It was a transparent ball, feather light, hard. "Take it for her. She'll like it. It will talk to her and show her pictures that illustrate its story. It is a story kaleidoscope. It will never repeat the same story. Look. What's a wirtzel?" he asked the sphere.

"Once upon a time there was a wirtzel who lived in a cave. . . ." The surface was vibrating. Images were beginning to form. The child watched in fascination.

"Look at it Kasumi! It would take your Frontier culture three generations just to *understand* the plans for that *toy*. Black Hole, woman. If it's knowledge you want, you need to take a university with you!"

She was crying.

Jotar hung his head. "What could I have done? Tell me. It was a disaster."

"You could have put your arms around me when I cry," she sobbed.

Kasumi left him in a turmoil. He thought all night about her, putting the pieces together. He could not sleep. He sat in a trance on the balcony, bathed in the light of the moon Schnapps, compiling memories. *We are, we are, we are, we are, we are the Engineers! we can, we can, we can, we can, we can swig forty beers!* Memories. The first drunken orgy when they had graduated from the Monastery, their vows of celibacy dead, singing, the mob, the screaming girls chasing after a piece of virgin, rioting, getting carried off by a flying wedge of amazons, to be young, to be proud that one could build anything. A long way from there to the duck blind. *I'll give you a herd of horses and you can start breeding me a flock of birds out of them!* Sarcasm. Maybe if one went back to the common ancestor of horse and bird you could breed a bird. A lot of breeding. Was Akira far enough back on the technological tree? Kasumi crying. *You need to take a university with you!* Why not?

He worked it out because she was leaving and his daughter was leaving and he had an irrational desire to go with them. His images were of them working side by side to build *the* ship on a world that cared.

To accomplish his purpose the ship of the Akiran trade mission had to be refitted. He still commanded that kind of resource. Its holds became a fifty person self-contained college subject to fast-time. He left room for six students in the crew's slow-time protective field. The best students could be cycled through slow-time with him and Kasumi so that he could work with them personally. He intended to

breed the best students until shipwright decisions were in their genes. By the time they got to Akira he would be bringing with him a 400 kiloday old university. It would have more tradition and history than Akira itself. With that base he could build a great ship even out there on Frontier.

Jotar was short of students. Who wanted to burn up in fast-time for a goal they'd never live to see? Misubisi Kasumi ordered some of her crew to become students and being good vassals they obeyed. Jotar found four Monks who had flunked out and couldn't bear the thought of becoming mere Technicians. He took them. He took three Technicians and two Craftsmen. He found six women like his mother and took them.

Only when they departed did Kasumi tell him that she was going in fast-time, to die in repentence for failing to carry out her mission. He couldn't convince her otherwise. She said that she wanted to work directly with the college in its infancy, to see that it grew up understanding Akira, the place where the descendants of the first students would work. But he knew she chose that exotic way to commit suicide because she had not forgiven him.

Jotar saw Kasumi only once again while she was still alive. Their first stop was at the small star Nippon where he picked up ten students and bought a quantity of genuine Japanese genes. His original students had inbred and were already looking too caucasian to be received smoothly into the Akiran culture. He had brought with him the frozen sperm of 1000 Engineers but he didn't want to have to rely on such a source.

Kasumi was old and wrinkled. They had communicated, but only through the time barrier where she lived 150 times as fast as he did. He was shy with her, his sorrow at losing her still fresh in his heart. Nor was it real to him that his daughter was older than he was, his grandchildren adult.

Nippon was a red star and consequently the surface of Nippon Futatsu was unnatural to human eyes. Kasumi took him to a mountain inn where she served him tea at a tiny shrine in a ceremony he did not understand. He could feel her warmth. It made him apologetic but she only smiled and pressed his lips gently with her hand.

"I have lived so long
That I long for the eon
Of rejected love
When I was so unhappy,
Remembering it fondly."

She poured his tea to refill the tiny cup. "Excuse my liberties with a poem by Kiosuke. Do you have a poem for me or is your mind too young to partake of such frivolity?"

The twilight inspired him. He did not know how to create a tanka.

"Why is the horizon tree
Fixed against the setting sun
When it is the sun that is eternal?"

Their talk concerned the college. Kasumi worried about the quality of the students. She knew that they were not good enough even to get into a Monastery on Lager. He laughed and

reminded her of their different perspectives. What seemed a painful and difficult development to her was a miraculously swift growth to him.

She held his elbow as they strolled along the lake to their solitary cabin which stood half on stilts. The only light she permitted was a candle behind a translucent wall. "Darkness is the friend of age. How fortunate I am. It is an old woman's dream to wake up one morning and find herself in an enchanted land with her favorite long lost lover, still young of body, potent, and yet not wise enough to have recovered from her charms!"

They made love on the mats, he amazed by her mellowness, she happy to be young again for an evening.

"Remember that Engineer who accosted you in the streets the day you arrived on Lager? You had to run away to save yourself."

"I do! I was terrified."

"That was me."

"Not you!"

"Yeah. That's when I fell in love with you."

"You beast!"

"I was zapped out of my mind. I cooked up that whole scheme to sell you ships just to meet you."

"But you left me!"

"Don't men always leave their first love? They don't have anyone to compare her with to know what they are losing."

"Jotar, you fool. Doesn't it terrify you to find men like yourself out among the stars?"

"The glorious stars gave me you. Is your head comfy on my shoulder? Gods, but I've missed reaching through that barrier to touch you."

When they reboarded their ship in orbit, Kasumi sent him as a gift her granddaughter by her fourth child. Yawahada was a vexing youth who, her grandmother confided in a covering note, coveted Jotar as a lover because he lived in slow-time and she was displeased with the men available to her and wished for a new generation of men to grow up while she remained young. Kasumi was dead and four new generations had risen before Yawahada of the budding breasts, now pregnant by Jotar, found a lover among her descendants who pleased her fickle heart.

By then the college was shaping in ways so fast that Jotar spent his full time monitoring its growth. Every tenth day he checked for cultural deviations that might destroy its purpose. He had the power to change what he wanted. Cultural evolution had elevated him almost to the mystical status of Emperor as provided for in the bushido ethic that came with the college as Kasumi founded it—he was the god from slow-time who awoke at intervals and judged.

After Kasumi's death Jotar began to run the breeding program with an iron hand by the best rules of animal genetics. He never interfered with the natural liaisons which arose among the Misubisis but he alone determined whose chromosomes were carried by every new embryo planted in a womb.

He selected for physical resemblance to the Akirani and for physical perfection—visual acuity that lasted into old age, longevity, coordination, flawless metabolism. You cannot breed for an ability your environment does not require. Jotar required cooperation, craftsmanship, and analysis and so was able to select for those characteristics. The improvement from generation to generation was remarkable.

Part of the improvement was cultural. As the college solved its problems of organizing and transmitting its knowledge it became easier for the less brilliant to do outstanding work.

Part of the improvement was the interaction between culture and breeding. Jotar wanted people predisposed toward fine craftsmanship so he set up a microelectronics industry to build starship brains. He bred the best craftsmen and hardened the electronic specifications from generation to generation until his students were actually selling their extraordinary products in various ports of call. He invented the science of positive and negative mass microstructures to teach kalmakovian fabrications in the limited space available onboard. It was only an exercise in craftsmanship to allow him to sort out his most talented students but they stunned him by producing actual miniature stardrives.

He never stopped delving through his brain for challenging projects. He had only fifty students but in fast-time they were the equivalent of 7500 students. They designed special ships to probe the fringes of black holes, automatic freighters, ships to penetrate regions of dense interstellar gas, ships to sample the atmospheres of stars, ships that could land on a planet, warships to meet the thrust of an alien invasion, tiny robot ships that could carry messages between the stars, a transport vehicle to carry 100,000 colonists. He listed every known ability required by a shipwright, monitored each individual for those abilities, and selected for them.

He seized all opportunities. When they were in some stellar port he sold their services to repair damaged ships of designs they'd never seen before. They had to work with their hands in unfamiliar shops and sometimes right out there in spacesuits. He contracted them out to the hardest problems at the cheapest price. They never complained. They did what he told them to do. They would have died for him.

The strange fast-time culture of the Misubisi took some devious turns. It developed a hedonistic period which produced a literature and spirit that grew up into a wisdom that got lost in a dark brooding upon the Japanese past that gave way to a rediscovery of simple crafts like pottery and multicolored wood block printing that led to a revival of dance and theater which produced a playwright who inspired political revolution and mutiny by twenty students whose places were filled by a new generation of loyalist fanatics whose children adopted the clothes and philosophical games of a passing port of call until their children

resurrected an Akiran identity from an almost devout curiosity about the coming Akiran experience.

And so they arrived at Znark Vasun, facing the empty Noir Gulf, Akira the most brilliant star in a sky forelorn of stars. Eight of the Misubisi jumped ship for passage in a freighter headed across the Gulf. It was the way they chose to reach the Akiran system alive to taste the final triumph of their millennia long quest. One slender Misubisi woman, filled with a romantic longing for an imagined Akiran paradise, unwilling to die while she was so near to heaven, seduced Jotar and begged him to take her with him in slow-time. He knew the source of her devotion but didn't mind; he liked her company and her body. Another young girl stowed herself away in his cabin, unwilling to grow old and die without building a real ship. He found her nearly starving long after they had left Znark Vasun. She was too afraid of his wrath to come out of hiding.

The remaining Misubisi continued in fast-time across the Noir Gulf as they always had and died there breeding new generations. The very last generation defied "the god beyond the barrier" by birthing a rash of "love children" who took the ship's population past seventy. They knew they were close to home.

Jotar weathered it all. Later he laughed and called himself the longest surviving Japanese Emperor in human history. Halfway across the Gulf they entered the peninsula called The Finger Pointing Solward. No one was happier than Jotar when their goal star showed as a disk.

Akira blazed on the portside.

They were adrift, the kalmakovian velocity reconverted to rest mass. Photon rockets blazed to life, changing their velocity by fourteen kilometers per second so that they could go into orbit around the planet Ohonshu.

They were greeted with incredulous enthusiasm. Akirani wept openly in the streets and on the farms. Two honor shuttles were sent to bring them down and, of course, they were landed at Tsumeshumo Beach where the first two shiploads of colonists had touched down.

Each of the Misubisi were given a torch and they knew what to do. Wild with joy they ran along the beach to the Shrine on the Jodai Hill where they embraced and cried and gave their thanks. Jotar marveled. Now he could build his ship! He went into the Demon's Dance with all of his old Engineering Power. And when he was finished he did a flourish of twenty rapid handsprings.

Panting, he saw that all Misubisis had frozen to watch him. For a second after he finished they stood still, then

they bowed. Takenaga's lords were there. They too bowed. The son of the governor of the Rokakubutsu System bowed. Other lords of the outworld systems around Akira bowed.

The first person to move was a graceful child, not yet a woman, who came forward with flowers. She kneeled and offered them, her eyes cast down, as she delivered a prepared speech thanking him for bringing them home. Strange how these people of his called this planet home.

He tipped up her face and kissed her cheek and gave her the smile he had often given to women back on Lager when he wanted to encourage their attention. That was his first meeting with Misubisi Koriru. They became friends. When she was older, she became his mistress.

And so here he was, too old to fight much anymore, philosophical about his last lost battle, going to a celebration that Koriru wanted him to go to when all he wanted to do was get drunk. Why was he starting to do whatever Koriru said?

Ah, those Misubisi. Those scoundrels that Kasumi had planted and he had nourished. They listened with alertness to everything said by the great Jotar Plaek. They hopped to attention and instantly obeyed his every command. But they always came back and, so sorry, they could not do what he requested, and please would he allow them the honor of disembow-

eling themselves or some such rot. When he refused they humbly offered a second inferior course of action, which, it always turned out, they had already implemented.

The ship had arrived to find a shockingly primitive technology on Akira—*that* was the trouble. Well, not primitive. One's choice of words could not be too strong. Incongruous was the word. Jotar fully expected to find a computer-guided wooden plow one of these days.

Koriru drove him to the outskirts of Temputo where they entered the procession that snaked through the city to the Imperial Palace grounds of the Takenagas. Happy people watched. Vendors scurried around selling hot delicacies to the crowd. Children watched from trees. Clowns wearing waldo leggings jumped about the procession to make the crowd laugh. Elaborate paper animals, some of them forty meters long, slithered among the noble daimyo. Computer-implanted birds of paradise added punctuation marks of color to the procession, flying back and forth, resting on the heads of children. Everybody waved paper accordian models of the Massaki Maru on the end of sticks.

At the Palace, lesser daimyo were separated from greater daimyo for the feasting. Jotar was pillowed with the greatest, the nobles of the Akiran tributary systems: red Rokakubutsu, Hodo Reishitsu, desolate Iki Ta, and beautiful Butsudo. All of these men stood to gain enormous wealth from an Akiran shipbuilding industry. Wiley old Takenaga himself—the man who had ended Akiran democracy and money wars between the merchant lords—even put in an appearance.

They liked the ship. The talk was all about *Imperial* Akira. Now they could expand down The Finger. At the knuckle end of The Finger was the whole of the Remeden Drift. Power, commerce, glory.

The moment came when the Massaki Maru was tugged from its assembly cocoon in space, already crewed for its maiden voyage to Butsudo. The Captain was in direct communication with Takenaga at the Palace.

"Heika, we await your orders!"

"Do us honor. Launch it!"

"Hai! Suiginitsu! Generate the field!"

"Hai!" came Suiginitsu's reply.

The first starship built on the farside of the Noir Gulf faded from the screen.

Jotar was not pleased. He was ashamed. Even in ancient times, had such an inferior ship ever come out of the shipyards at Lager? The acceleration of the Massaki Maru was shockingly sluggish. It's top velocity was ninety light speeds. Too many compromises had been made with reliability. Fast-time ruthlessly destroyed unreliable systems. He doubted that the ship would last more than five kilodays in service.

The Misubisi collective decision had been that it was more economical to build such a ship than to import a

better one from across the Noir Gulf. They were right if they manufactured at least twenty of them. Still he was ashamed. He would not have come to the rim of civilization for that.

Later, as the confusion of the feast brought forth a new course of food, one of the Misubisi women came to him.

"Hanano! You're as nervous as that day I found you starving in my closet! What is it? I know. You're afraid that load of junk will shed its skin all along the route to Butsudo! No matter. Eat! Sit with us! We'll spend an hour here together and afterwards rub pot bellies!"

She fingered his hair affectionately. "If I had only known what a monster you were, I'd have chosen to die in the Gulf rather than throw myself at your mercy. Come." She tugged at him. "I beg of you to come with Koriru and me."

"You will please come," said Koriru.

They took him to one of the Palace gardens where some thirty of the Misubisi clan had gathered. More of them weren't there only because they had vowed the whole clan would never meet in one place at the same time. The handsome hulk of Misubisi Jihoku confronted them.

"Hanano! You found him, the Disapproving One! Welcome. Koriru, you've kept him sober! How do we honor such self-sacrifice!"

"I'm not sober, you pile of shit!" he retorted.

"In my unworthy opinion, Plaek-san, when you can still walk, you are sober!"

There was laughter, but nervous laughter. They knew he despised their ship, had not wanted it built.

"If that junk heap just gets back here, I'll give you all gold stars!" Jotar roared drunkenly. "Not for your engineering abilities, but for your monumental good luck!"

Jihoku laughed. "Water on a frog's face! We have a millennia long tradition of your insight into our inconsequential efforts, threads holding together a history longer than many planets, longer than Akira's, and throughout it all we have learned the joy and profit to ourselves of carrying you, oh noble bag of complaints on our backs. Complain away!"

The Misubisi cheered Jihoku goodnaturedly. They were happy. They were celebrating. It was their day.

Koriru stepped forward. "If I may be allowed to intrude, I have a poem from that tradition. Misubisi Kigyoshin of the twenty-third generation wrote it when the plans of his life's work were cut to pieces by Plaek-san. We were at Kinemon and they had met face to face.

Built of my sinews
Flowing over nebula
My crafted starbridge
Pleases not our tortoise god
Whose dreams are swift as wishes

He's been slashing at us since the mists of our time and his criticism has made us great!"

"Hai!" yelled thirty voices.

Hanano stepped forward, trem-

bling. She had desperately wanted to build ships and had spent her time with him in the Gulf picking his brain. She was his top engineer.

"We wish to give our tortoise god a gift tonight from our hearts and from the hearts of all our ancestors. It will not be good enough but it is our best."

Jotar was sobering. They were afraid of him, really afraid of his disapproval. And yet . . . somehow . . . they were about to give him something . . . if he disapproved . . . they would be destroyed.

It was a wooden box the size of a coffin and he opened it. The model of a starship floated out, glowing bluely. The name on the bow, printed not in their chicken-track script but in Anglish, was *The Jotar Plaek*. It was his ship. But it wasn't.

"The field fins are wrong," he said.

"I am so sorry to disagree," said Hanano, "but they are a solution to the field equations subject to the fabrication constraints we have assumed."

The robed shipwrights were tense.

"You're telling me that you're building this ship?" He stared about the garden crazily.

"Hai!" said Hanano fiercely. "I have personally checked the entire critical path analysis. We know every problem that will arise, when it will arise, and how to solve that problem. *The Plaek* is to be a fifth generation ship. We are to build ships of the Massaki Maru class for two more kilodays at which time the Akiran craftsmen will be ready to build the next generation's prototype. Our fourth generation will be the first significant departure in starship design since Lager produced the Hammond variation. The fifth generation will be your ships."

Jotar stared at her. "And how long is this going to take?"

Jihoku spoke up. "I am very displeased to inform you that you will be dead by then." He bowed to express sorrow.

"I guessed there was a catch."

"We respectfully remind you," lashed out Koriru, "that you have asked thousands of us to die in this adventure. Only a handful of us survive!" She swept her arm about the room. "It does not matter that we die before the summit is reach. Banzai!" Ten thousand years. "It matters only that it is reached!"

"Do you think you can do it?"

"Hai!"

"Why didn't you tell me that this was going on?"

"We wanted to be sure. It was a gift we could not offer lightly. Our honor as shipwrights!"

Jotar Plaek held the model in his hands, turning it about, the tears running down his aging cheeks. He stared at the name printed on the bow.

"Look at that. A fat lot of good that's going to do me! Have you ever met an Akiran who could pronounce my name! Have you?" he challenged them all.

Then he was hugging his Misubisi people, each of them, one at a time. ■

Negative theorems are the hardest to prove. But to an engineer, negative experimental results are proof enough.

In Search of the Bootstrap Effect

RUSSELL E. ADAMS, Jr.

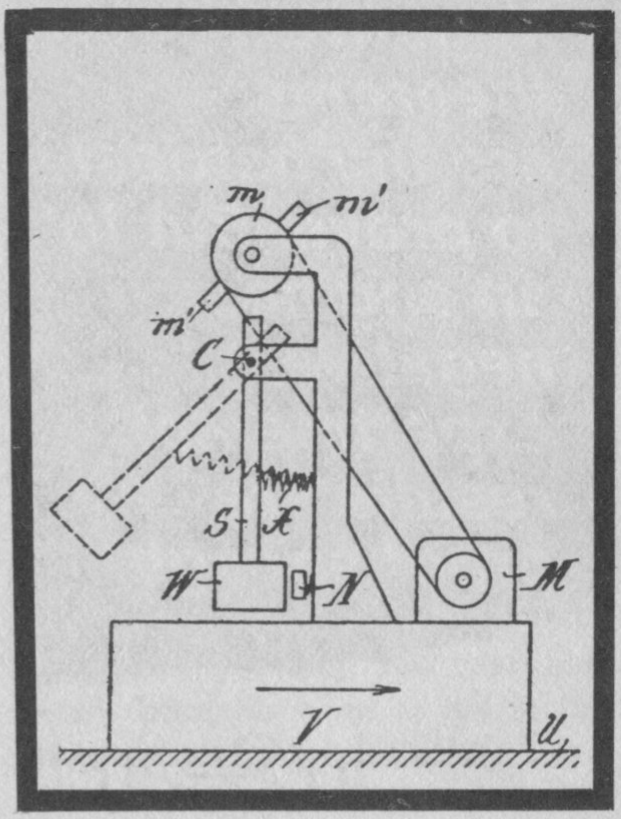
I first heard of the Dean Drive in 1963. The principle fascinated me—conversion of energy into motion without reaction. A friend had showed me the article in Analog about the Dean Drive and the article by Davis on his fourth law of motion. We were both active in our high school's science fairs and these two related articles seemed to us to have terrific possibilities for science fair projects. So we divided the research. My friend embarked on the construction of a model of the Dean Drive, and I designed some experiments to test Davis's theory. Our research lasted through graduation from high school and my friend and I went off to college. During the next four years, I put aside my interest in the Dean Drive, and it was not until several years after graduation from college that my interest was rekindled.

I stumbled upon a stack of patents in the U.S. Patent Office, all concerned with various types of space drives. There were at least 50 of them. It was clear that Dean had neither been the first nor the only inventor of a space drive. Even if the Dean Drive did not work (a conclusion my friend was reaching at the end of his research project), perhaps one of these other inventors had discovered the secret of reactionless space propulsion. As I studied these 50 some-odd patents, a pattern began to develop. There seemed to be three approaches taken by the different inventors to the production of reactionless thrust: drives using impulse force, drives using cen-

trifugal force, and drives using gyroscopic force.

Impulse drives attempt to use impulse, the sudden application of a force, to produce thrust. The Dean Drive falls into this category. A simpler example, however, is the invention of Rudolf Goldschmidt (see Figure 1A). The Goldschmidt Drive used the impulse from a hammer as it impacted with a stop. The idea was to pull the hammer back slowly so as not to move the device and then to let the hammer free fall through an arc and smash into the stop. This was supposed to produce motion.

To test this device, I built a model from an Erector set (see Figure 1B). It did move across the table each time the hammer impacted with the stop. However, when I put wheels on the model, (see Figure 1C) the motion disappeared. It merely oscillated back and forth. Why? It has to do with static friction. Static friction is present when there is no relative motion between an object and the surface it is sitting on. The energy used to pull the hammer of the model back was the same as that released when the hammer hit the stop. The static friction between the table and the model without wheels was great enough to hold the model still while the hammer was slowly lifted. However, the static friction between the table and the model with wheels was not great enough to hold the model still during the hammer lift. Thus, it moved in one direction when the hammer lifted and moved equally in the other direction



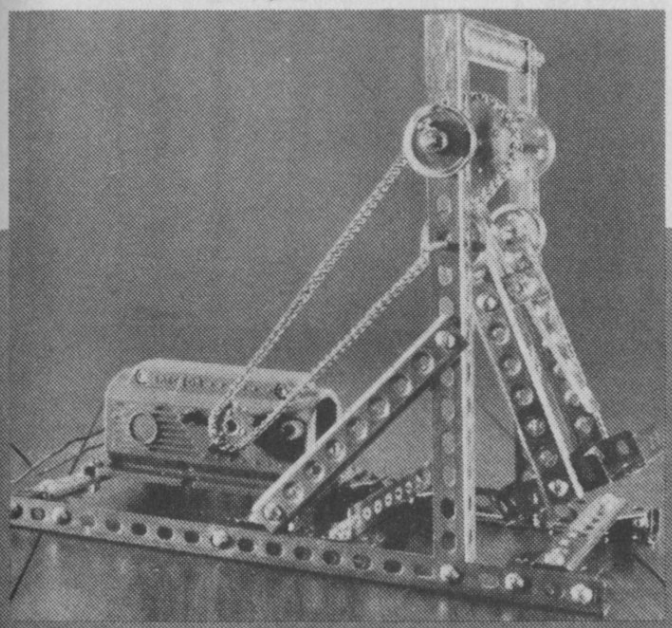
1A. GOLDSCHMIDT DRIVE

when the hammer hit the stop. The model with wheels is more similar to conditions in outer space, where there would be no static friction.

The Dean Drive uses an oscillating carriage in the same manner as the hammer in the model. An impact is produced when the clutch suddenly grabs onto the load tape. The energy used to lift the carriage is equal to the energy released when the clutch grabs the load tape. Thus, if the device were in outer space (that is, a frictionless environment), it would move slowly in one direction when the carriage was lifted and suddenly but equally in the opposite direction when the clutch grabbed the load tape.

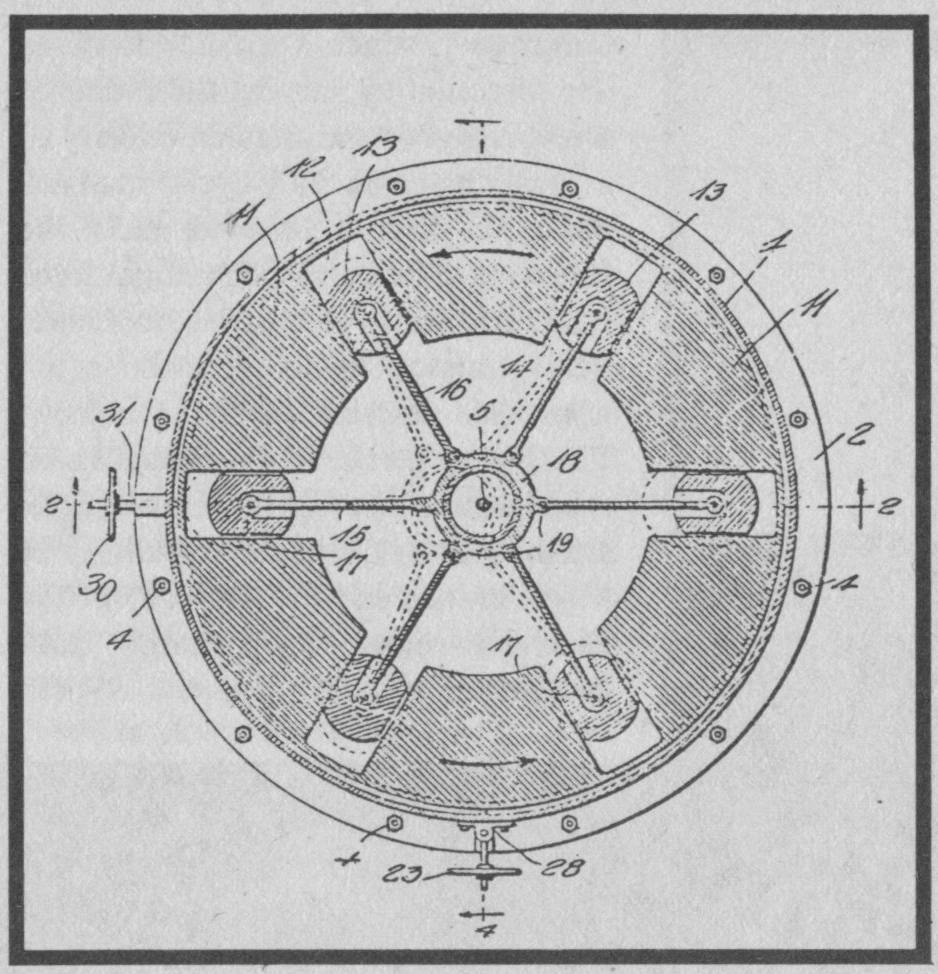
The second category of space drives, centrifugal force rectifiers, at-

tempt to produce a greater force in one direction by varying the radius of a revolution or the angular velocity of a revolving mass in a cyclic manner. As a physicist, I have to make the following statement: Centrifugal force is an imaginary force. It is a mathematical gimmick to simplify the equations that describe revolving objects. The forces that hold the Moon in an orbit around the Earth, for example, are the gravity of the Earth pulling the Moon inward and the tendency of the Moon to remain in a straight path tangential to its orbit—not a path



1B.

1C.



2A. LASKOWITZ DRIVE

directly outward from the Earth. Neither of these forces is directed outward from the Earth. Neither of these forces is directed outward from the center of the orbit.

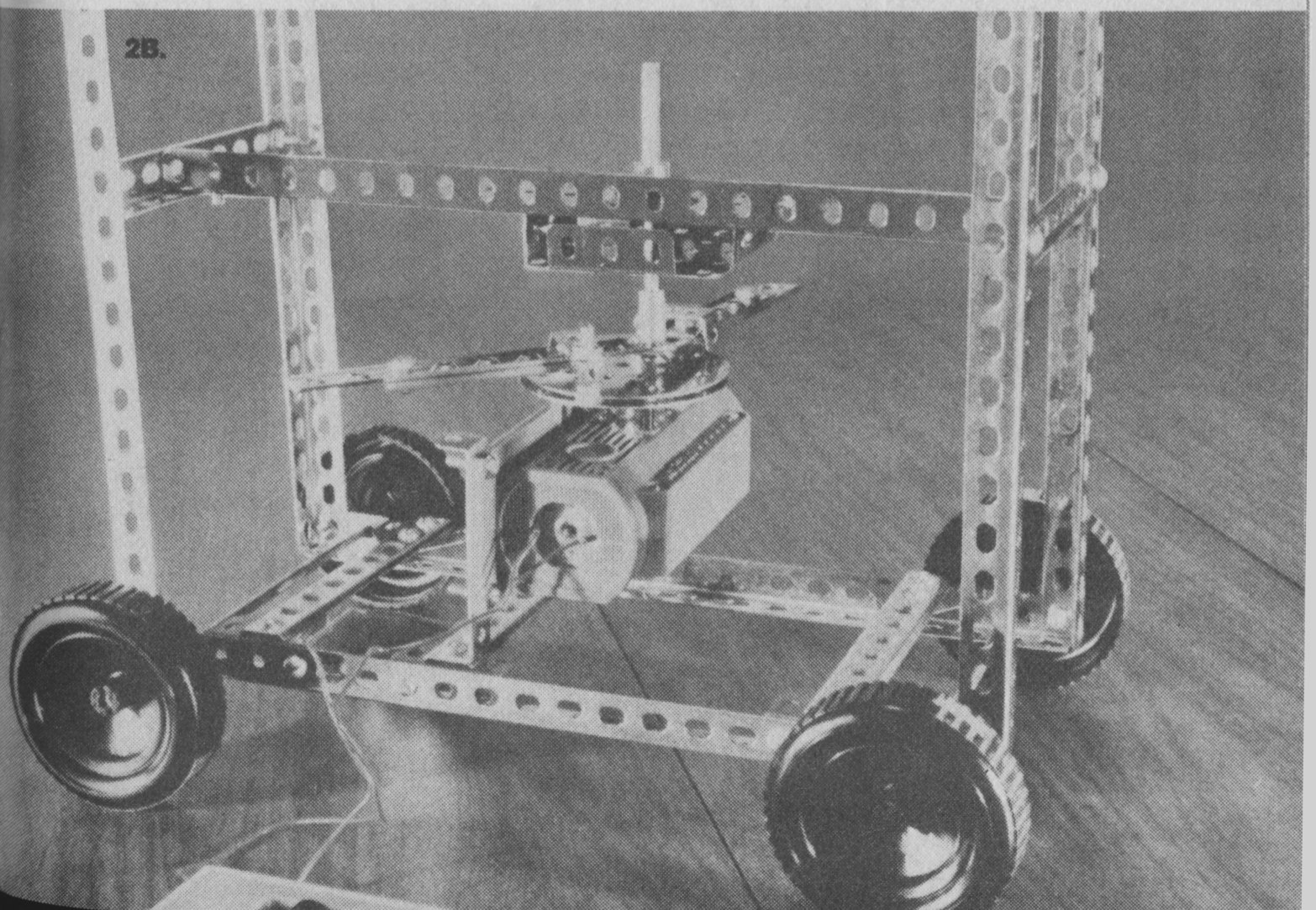
A simple experiment will illustrate this point. Tie a string to a weight and swing it around your head. The weight appears to be pulled outward against the center. However, if the string is suddenly cut by a razor blade, the weight will continue in a path tangential to the orbit, not in a path straight outward from the center of the orbit. Devices attempting to use centrifugal force ignore the tangential direction the revolving object would take if the force pulling inward ceased.

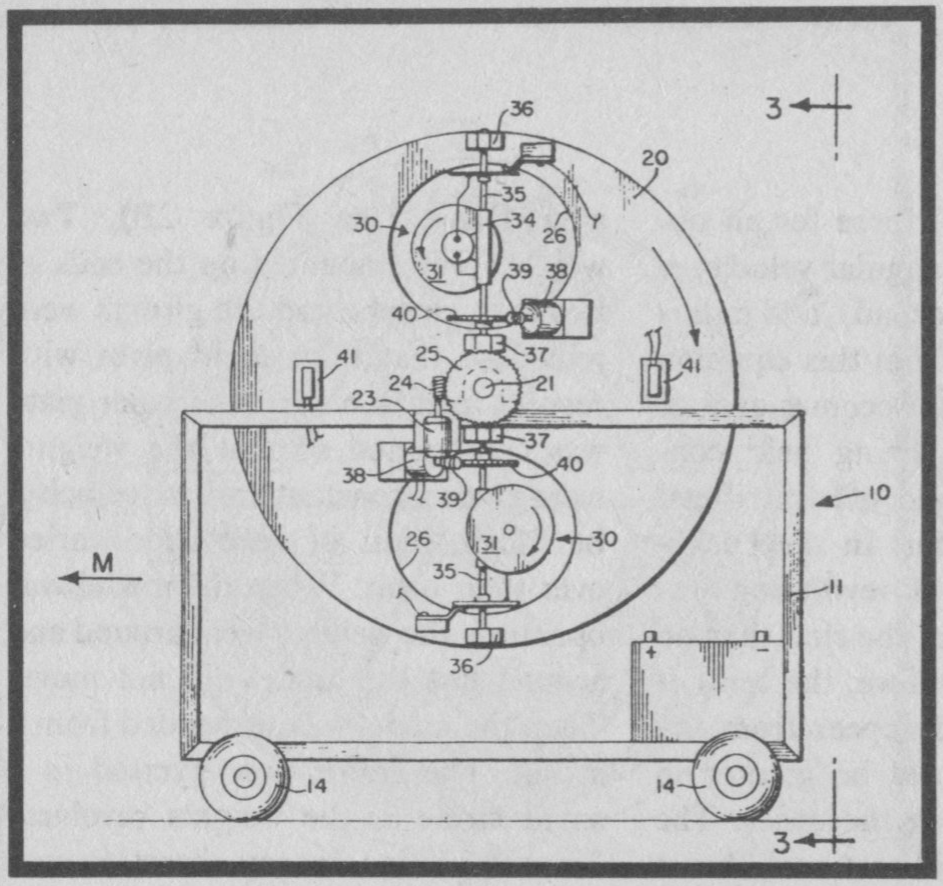
An example of a centrifugal drive is that invented by I. B. Laskowitz. The Laskowitz Drive had a plurality of weights connected to a central axle by way of pivotable connecting arms. The weights were fitted into cylindrical bores of an independently rotatable ring (see Figure 2A). The axis of rotation coincided with the central axis. The ring was rotated by a motor, and the weights in the bores of the ring also rotated. The central axis was displaced from the axis of rotation so that the radius of rotation of the weights would vary as the weights rotated. As we can see, the weights would have a constant angular velocity.

The equation $F=mw^2r$ is the mathematical gimmick which gives the ap-

parent "centrifugal" force for an object having mass *m*, angular velocity *w* (in revolutions per second), and radius of revolution of *r*. From this equation we see that, as radius becomes greater (mass and velocity being held constant), the magnitude of centrifugal force becomes greater. In the Laskowitz Drive, radius of revolution was greater on one side of the ring than on the other side. Therefore, the centrifugal force, it would appear from the equation above, would be greater in one direction than in the other. The result would be unidirectional thrust in the direction of the greatest force.

Again with an Erector set, I built a model that approximated the Laskowitz Drive (see Figure 2B). Two weights were mounted on the ends of two long girders, and the girders were joined so that they could pivot with respect to each other. A circular plate was constructed so that the weights were given a constant angular velocity, but their radii of revolution varied over their orbit. When the model was operated, the weights went around and around but the model did not move. Then the model was suspended from a string. The frame now gyrated in a small circle as the weights revolved. No net motion in any direction was detected. The reason the Laskowitz Drive and my model do not work is that they produce an equal force in





3A. FOSTER DRIVE

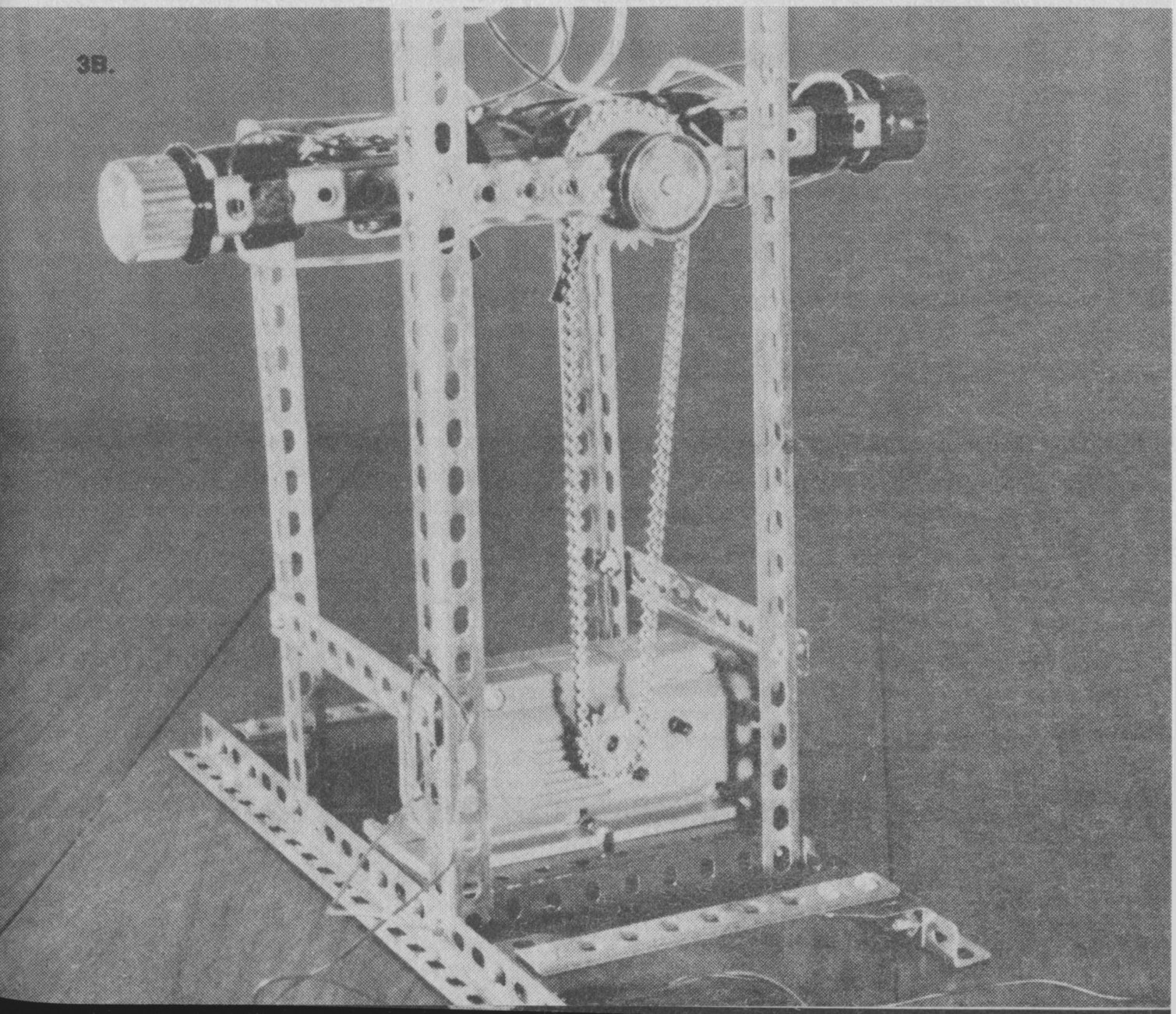
both directions. When there is no static friction to overcome, as with the model suspended on the string or in outer space, the devices simply gyrate around the center of mass of the device.

This happens because the unbalanced centrifugal force which was supposed to produce motion was not a real force. The mathematical equation to describe the apparent force only holds for describing the apparent force felt by someone or something *on the revolving object* and does not hold if the someone or something is not on the revolving object. When you round the corner in your car, you feel an outward force. However, an outside observer would see that your body is trying to continue in its original path, a path tangential to the curve. The concept behind the centrifugal devices is in error because it attempts to take an apparent but unreal force felt on the revolving object and apply it to something not on the object, the outer stationary frame of the whole device.

What is actually happening with a centrifugal device in a frictionless environment is that the weights are attempting to continue in a path tangential to the orbit. The motor is exerting a force on them to keep them moving in the orbit. This force creates a torque on the weights, which is then distributed proportionately to the entire device according to the mass of each element of the device. As a result the entire device will rotate around a point which is the center of mass of the device. To put it in a few words, you cannot lift yourself with a force

that is not there. Therefore, the centrifugal force drive seems to be a dead-end approach in the search for a workable space drive.

The third type of space drive attempts to use gyroscopic force to produce thrust. The only patented gyroscopic force drive I know of was invented by Richard E. Foster in 1970 (see Figure 3A). Foster's space drive consisted of a 16-inch wheel rotated by a motor. Mounted on the edge of the wheel were two thrust units. Each of the units was composed of an inertia wheel 2.5 inches in diameter supported on and rotated by another motor. The inertia wheel and its motor, in turn, were mounted to the 16-inch wheel in such a way as to be rotated by a third motor around an axis parallel to the 16-inch wheel. In operation the inertia wheel rotated about the axis four times each rotation of the large wheel. However, each inertia wheel was only under power for half a rotation of the large wheel in order to eliminate the reaction thrust which would otherwise have been produced.



The entire unit was mounted on a wheeled platform and, when activated, moved across a flat surface at 4 m.p.h.

A model of the Foster Drive is a bit difficult to build with an Erector set, so I built a modified version (see Figure 3B). Two small motor-driven gyros were mounted at opposite ends of a rotatable arm. The gyros were started so as to rotate in opposite directions with respect to each other, and the arm was rotated about a central axis. The model jumped around and torqued but appeared only to move in a random fashion. No net unidirectional motion was observed. The model was based on the premise of an "inertia propeller." That is, the two oppositely spinning gyros torqued in the same direction would tend to turn in a direction perpendicular to the plane of the rotating arm. The device would thus be pulled along by such a perpendicular force. Since the model is not an exact copy of the Foster Drive, the fact that the model did not thrust does not rule out the possibility that the Foster Drive does work. However, it tends to indicate that simple gyroscopic drives probably will not work.

In conclusion, it is not my intent to debunk the concept of a mechanical space drive. However, centrifugal drives have no chance of success in my

in times to come

Science fiction should be a "natural" subject area for the motion pictures and television, where the camera can be used to show very realistic vistas of fantastic future scenes. Yet most of the "sci-fi" shown on theater and home screens falls sickeningly short of what these media could accomplish. Interestingly, there has also been a dearth of published science fiction that deals with the future of these entertainment media.

Next month's lead novelette, "The Nuptual Flight of Warbirds," by Algis Budrys, examines the curious borderland between reality and fantasy, between entertainment and life, in a story that is thematically, stylistically, and dramatically a masterpiece. And to go with it, we have a masterful cover illustration by Richard Powers.

May's issue will also feature a new look at the prospects for thermonuclear fusion power, by Dr. Milton Rothman. Fusion is still in the laboratory, but it's getting to "break-even" point, which means we should start thinking about its "breaking out" of the labs and entering the realm of hard-hat engineering.

We'll also have stories by Stephen Robinett, Orson Scott Card, and as many others as space permits. Plus our usual features and an analysis of the Annual Analytical Laboratory results.

opinion. Impulse and gyroscopic drives might work. However, in order for simple impulse or gyroscopic drives to produce a unidirectional thrust there would have to be a gross departure from known physical laws. The idea that such a gross departure would not have been noticed in the three hundred year history of mechanics seems inconceivable.

This is not to say that a mechanical space drive cannot be built. However, the machine would have to be of a type which would create specialized conditions in which Newton's Laws would not apply.

I have played with the idea of mechanical space drives for over 13 years. I have built numerous models, none of which produced any measurable reactionless thrust. Yet, I still am fascinated by the concept. There must be a way to do it! ■

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The Near-Zero Crime Rate on JJ Avenue

WILSON TUCKER

"Halt! I cite Public Law number six."

Solly Paro climbed out of the car in the middle of the street and looked with no alarm at the robot policeman already racing toward him. The cop's left waldo was raised in attack position and a small hinged door in the navel location was open for laser firing, if that was necessary. Paro deliberately turned his back on the machine and reached into the car for his luggage. He knew precisely how far he could go and how much he could taunt it before the block patrolman immobilized him.

Public Law number six was for villainy and wickedness.

The 250th Street crosstown car had stopped in the middle of the intersection and discharged him on the downblock side of the street. The conveyance wasn't blocking traffic; JJ Avenue was a walkstreet forbidden to vehicles and there was no cross-traffic to be blocked. The human driver of the car made no gesture to help with the luggage but instead watched Paro with an easy patience but little interest.

The driver's gaze shifted when the cop arrived.

Solly Paro straightened and turned around carefully to face the block policeman. Nit-picking machines had to be handled carefully to avoid arousing suspicion. He ignored the outstretched waldo and stared up into one or two of the tinted plastic eyes. Paro guessed that one eye was watching him while another was focused on the driver. The remaining seven lenses encircling the head would be watching JJ Avenue to either side, and the long block behind it. There was more. An omnidirectional microphone protruding from the top of the head could detect a whisper at the far end of the block.

Paro seized the lead. "I want a broad for the night. How much is in it for you, old buddy?" He grinned broadly.

The robot asked: "Are you a citizen of Chicago?"

Indignation. "Sure, I'm a citizen—of course I'm a citizen! Now, how about that broad for the dark hours, eh?" But Paro knew very well his request would be ignored until it was properly phrased. Robots possessed limited vocabularies. "Oh—you want to see my I.D., eh?"

The robot said tonelessly: "Reveal your I.D. and place the card in the slot." The machines lacked a sense of humor.

Paro loosened his shirt and pulled out two plastic identification tags hanging about his neck on a long chain. The patrolman's lens watched carefully as Paro selected a white card and deftly inserted it into a slot embedded in the stainless steel chest. The card went in all the way up to the ring that fastened it to the chain.

Paro waited while the machine digested his carefully concocted identification. He continued to grin in friendly fashion, as if he believed one could be friendly with robots.

"Welcome to JJ Avenue, citizen

Paro. This is a quiet family neighborhood with a near-zero crime rate, located between 250th Street and 251st Street. JJ Avenue is designated a walkstreet with all vehicular traffic prohibited pursuant to Municipal Code number 770, subsection 44B, as amended 16 July 1990. The reverse side of your I.D. signifies that you have been advised of your rights in the event of arrest. Obey the laws." The menacing waldo dropped away and the tiny door closed to conceal the laser behind an artificial navel, but of course there was no change in the machine's tonal delivery. "To determine your future residence, remove the first card and insert the second card in the slot."

The newcomer did as he was told, inwardly pleased that his forged I.D. had been accepted so readily. He *needed* a nice quiet family neighborhood with a near-zero crime rate, *needed* a hideaway from prying eyes, and the second card now reposing in the robot's chestal slot should gain him entry into a vacancy. Solid citizens were entitled.

"Remove the second card and prepare to follow me, citizen Paro. An unoccupied dwelling is available at number 34, east side of street." The block policeman didn't shift its massive body nor move the head containing those nine eyes, but its attention turned to the driver blocking the road. "Remove your vehicle and follow your route, citizen driver."

Citizen driver said: "Yep," and drove the car away.

"I require inspection of your luggage, citizen Paro, pursuant to Public Law number 61, paragraph (e)."

The newcomer opened the two suitcases and held them up for inspection one at a time. Now the right waldo rummaged among the clothing seeking metal objects. There were none.

"Follow me, citizen Paro." The machine did not turn on its wheels but simply rolled away in reverse, all the while watching with one or more eyes to see if the newcomer would follow.

Solly Paro closed and locked his two suitcases and trudged after the block policeman. He didn't look around, didn't look behind him, but he knew what was there. Just across 250th Street another patrolman watched him go. That other robot had also raced to the intersection when the crosstown car stopped to discharge a passenger, and then had silently waited to learn which block the newcomer would enter. Paro's reception would have been identical if he had gone that way, and those two forgeries dangling at the end of the chain would have gained him the same reception. A master craftsman in Vegas had produced the forgeries, a man of cheerful countenance and supreme confidence who would have patted himself on the back had he been standing by to witness the confrontation.

A circus of children played in the street under the watchful eyes of the guardian.

JJ Avenue was three meters wide and paved with hard asphalt; it had rain gutters on either side of the street

together with catch basins to carry away the water, but no more than that. JJ Avenue lacked sidewalks, lawns, trees, grass, weeds, shrubbery; it lacked dogs, cats, squirrels, birds, rodents; it lacked breathing space and privacy. Both sides of the street were lined with row houses that abutted the asphalt paving, being only a step above the gutters to prevent rainwater from seeping under the doors. The row houses were built on the street itself, crowding it and crowding one another, not leaving so little as a millimeter of soil and growing space between street gutter and concrete wall. There was no room for ants or roaches or centipedes, no room for worms to emerge after a drenching shower. JJ Avenue was an asphalt strip between two identical rows of concrete block buildings, a walkway three meters wide separating east side doors from identical west side doors.

JJ Avenue was a claustrophobe's horror but an uncaring bureaucrat's dream—a bureaucrat charged with solving the problems of high density population and maximum security, coupled with optimum civil control. Solly Paro viewed the scene only as a splendid place of concealment.

The guardian stopped before one of the myriad doors.

"Number 34, citizen Paro. You may enter."

"Oh, no I don't! You didn't search the place."

"This is a high security area without intruders. I lock the doors at nightfall."

Solly Paro put down his luggage and stubbornly folded his arms. "You haven't scanned it."

The robot didn't sigh but merely said: "A scanning is your lawful right. Will you place the ramp in position?"

Pretending an extraordinary caution that didn't really exist, Paro flattened himself against the wall of the house and stretched a hand to turn the knob. He let the officer know that he was a careful citizen, an aware citizen, and one who would not thoughtlessly stand between a policeman and a criminal lurking within the house. The door swung wide, with his body well away from possible danger. Some of the children stopped play to watch the charade.

Nothing happened, of course, so he reached down and around the doorframe to retrieve the small ramp resting just inside the door. The ramp was fitted into position over the curbing, stretching from street to doorsill, an act that legally gave policemen the right to enter a dwelling without first obtaining a search warrant.

"The entrance ramp is in position, citizen Paro. I may enter this residence pursuant to Municipal Code number 350, subsections 1A and 1B, as amended 23 November 1992, and as further amended 4 March 1993. Stand aside."

"Be my guest," Solly Paro replied.

The robot policeman hesitated a moment longer to first scan the block for evildoers and to check on the children. Finding nothing amiss after the

careful scrutiny it wheeled itself smartly up the ramp and into the first room, the leisure room, where it stopped in the precise center and began the examination. The nine eyes probed the small room for unwelcome intruders; the sensitive microphone listened intently for the sound of breathing, or heart beats, or gas rumbling in the intestines; while the waldoes were poised for instant seizure of anything that moved, even a mouse. The newcomer and some children waited for a denouement.

"The leisure room is uninhabited, citizen Paro."

Solly moved to the open doorway the better to watch. The robot wheeled itself into the bedroom, where the probe was repeated. "The bedroom is uninhabited, citizen Paro." And a short while later a third and final clearance came from the now unseen investigator. "The bathroom is uninhabited, citizen Paro."

"Except for you," the citizen muttered.

"You requested entry and examination, citizen Paro." The robot rolled back to the door and down the ramp. Again it scanned the block for miscreants and then counted the number of children. An eye looked at those grouped around the doorway and both waldoes waved out a gentle gesture. "Retreat. Disperse."

They dispersed but not before one of them made a rude noise, a noise not in the guardian's vocabulary.

"Will you remove the ramp from the door, citizen?"

The newcomer to the family neighborhood picked up the ramp and carried it into the house. His satisfaction was genuine. A moment later he popped out for his luggage.

"Very good," Solly said. "Very efficient. One hundred and one percent self-contained. A full house, officer."

The machine failed to move away, and would not move until the man had closed the door between them. Solly Paro wasn't quite ready to shut it out. There remained the matter of a queen for the night and the block policeman was the only available source.

"I want an overnight female companion. What is the cost?"

The answer was prompt because the phrasing was correct.

"Two quality grades are available, citizen Paro. The lesser costs twenty bobs, the better costs fifty bobs."

"*That* much?" His surprise was only feigned; the Vegas broads were much more costly. "What's the difference, eh?"

"The better grade is guaranteed to be free of disease, after submitting to daily medical examinations."

"Is that so? A clean deck guaranteed?" Solly gave the matter some thought and then asked the last question. "Is there an extra charge for your services, eh?"

"None, citizen."

"All right, I choose a fifty bobs female."

"Of what description, citizen?"

"Ah—*now* we're talking. Make her short, childlike, but well built and chesty—know what I mean? I'd like a

blonde. A nice tan if you've got one, but what the hell, just so she's blonde. Will do anything, salute the flag. A good talker, and somebody who can play poker. Now, listen, good teeth—that's important. I don't want no female with bad teeth. I had one once but her denture fell out."

"Clarification of description needed, citizen."

Solly sighed, held his temper, but stared up into two or three eyes. "The female is to be short in height, maybe up to here." He put his thumb to his chest. "Bosomy, and a blonde with tanned skin—if that's available. One that can carry on a decent conversation, and can play poker. Good teeth—*that* is a prime requirement. Very experienced, capable of just about anything. Got it? And don't forget the chest, eh?"

"All females have chests, citizen."

"All ironmen have tin ears, officer."

"The designated female will arrive before curfew, citizen Paro. Sunset this day occurs at nineteen hundred hours plus fifty-two minutes. I will call curfew and lock the doors at that time. Obey the laws."

"A warm blonde for the dark hours, eh?" citizen Paro responded, and shut the door in the policeman's non-face. Paro was an unabashed hedonist. His imagination wallowed in the idea of being locked up for the night with a new woman.

There was scarcely enough room inside the house to swing a cat, if cats had been present in the neighborhood. The leisure room was an exact four meters square with a small dining table, two upright chairs, and a few pieces of lounge furniture nearly filling it. The ceiling had a single light. There was no carpet. One entire wall was given over to the necessities of the good life: a cold water fountain, a laser oven with the food delivery bins next to it, a trash and garbage receptacle below the bins, a two-way radio-telephone that also served as a tornado and air raid warning system, a slot for the weekly delivery of mail, and finally a glass television screen that was much too large for the dimensions of the room—but then, that oversized screen was designed for the hypnotic effect it produced on a captive audience. A passive populace was a safe populace.

There were no windows in the house, nor was there a back door.

The bedroom was appreciably smaller than the leisure room but it contained a standard-sized bed, a wardrobe, and one night light in addition to the usual ceiling light. There was an auxiliary speaker built into the wall above the bed, if the occupant wished to pipe the radio program into the bedroom. That speaker also awoke the occupant and warned him to crawl under the bed in the event of a tornado, or an air raid.

The bathroom was smaller yet, with a shower space so cramped that only the most amorous, tactile-sensitive couples would think of squeezing into a cubicle meant for one. There was a stool, a mirrored wall cabinet, and

some plastic shelving that now held a bar of soap and a half dozen towels made of woven copra. As in the other two rooms, carpeting or bath mats were absent. One light was fastened above the mirrored cabinet and one outlet was provided for accessories.

Families with children lived on the other side of JJ Avenue, in more luxurious housing. Those families were entitled to an extra bedroom, two bars of soap, and additional towels. The housing authority of Chicago provided cribs to families with babies, and a small toy chest that fitted beneath the crib. The block policeman furnished explicit instructions for reducing adult fare to baby food, and made weekly examinations of the infant's state of health.

Solly Paro was impatient for his female to arrive. He would have paced the floor if there had been room to pace.

He was acutely aware of the lateness of the hour and now he wondered again—this time aloud—if the cop outside was really honest. He was equally aware of the two hungers destroying his patience and his temper: stomach and libido. Or perhaps the priorities were reversed: libido and stomach. No matter—both were making insistent demands on him. His original thought had been to wait for the woman's arrival before ordering dinner; it would be fun to eat together and then drift on to other things. But the hours of twilight went on and on without her appearance until at last he had flipped on the television and tuned to channel one to read the menu.

These meals served only between 1600 hours and 2100 hours. To order a meal insert your WHITE I.D. CARD in the telephone slot and then:
First DIAL 54 or KI,
then DIAL YOUR DOOR NUMBER,
then DIAL MEAL NUMBER,
then DIAL ONE (1) and hang up.
Remove your I.D. card from slot.
When meal is delivered follow instructions for cooking.
Tuesday dinner 101: Cultured chicken
Tuesday dinner 102: Syracuse stew
Both meals served with mixed vegetables analog, green salad analog, pure flour biscuits and rice honey, protein pudding (vanilla), powdered drink. NO coffee, tea, or milk served on Tuesdays.

The menu choices stopped his hand on the telephone and momentarily damped the hunger in his stomach. He knew what cultured chicken was but he wasn't all *that* fond of spun soy protein no matter how appetizing it was served up, no matter the skilled cosmetic job performed on the product. And the Syracuse stew really puzzled him, nagged at his memory. What meat? Syracuse was where the university was, and the people in that university had built a meal teeming with vitamins, nutrients, and all

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Edited by Lewis M. Greenberg and Warner B. Sizemore

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that—but *what* kind of meat was it, eh?

He left the menu on the screen and started for the shower, deciding that if the female hadn't arrived by the time he was finished, to hell with her. And to hell with that cop lurking outside—him and his nine weird eyes. The cop was dishonest after all. He would file a complaint in the morning and try to recover the fifty bobs.

An authoritative waldo banged on the door.

Solly Paro spun on the soles of his feet and ran from the bathroom to the front door. Mindful of his appearance, he rebuttoned the shirt that was hanging open.

"The female has arrived, citizen Paro. Curfew in four minutes."

The girl cried: "Loverpops! I'm Stevie. Want to play stooka? Let me in, I'm ready for anything." She carried an overnight bag.

Solly Paro stared down at the young woman with open astonishment and then turned on the patrolman.

"Not fair—not fair! Only four minutes! *This* isn't what I ordered, *this* isn't what I paid for."

"Short, childlike," the policeman quoted to him. "Bosomy, good conversationalist, can play poker."

"Not *that* short," Solly protested. "She's just a kid! And she isn't a blonde—I ordered a *blonde*."

"But Loverpops, I've got a blonde wig in my bag. And a red one, too. Do you like redheads?"

"Not fair!" Solly cried again.

"A genuine blonde female fitting the description was not available, citizen Paro. The present female fits all other particulars: experienced and capable of anything. She has no dentures and will salute the flag."

"Look at my teeth, Loverpops." The girl opened her mouth to display a perfect set, freshly scrubbed. "Look, *see,* pretty. Do you have a fancy for teeth? I have a pair of white boots in my bag—do you like boots and teeth?"

"You're only a kid!"

"I am not, I'm *nineteen,* I'm legal."

"The female is of legal age, citizen Paro. Curfew in three minutes."

"Frame! Rotten deal! Stacked deck!" Paro had the sudden suspicion that the woman had been deliberately held back until only minutes before curfew. They were cheating him, and the tardy delivery was a part of the deception.

She said: "I'm good at poker, Loverpops. I like five card stud, what do you like?" The girl giggled and raked his lean body with a calculating stare. "I'll bet you're *good* at stooka. Wink when you're ready."

"I ask for a woman and get a little girl," he wailed. Solly lifted his gaze to the night sky and made protest.

"Less than three minutes, citizen Paro. You did not specify a particular age."

"I didn't specify a little girl, either!"

Stevie thrust out her chest. "*Look* at me, Loverpops. I'm a big girl. Please tell him I can stay."

analog

A Calendar of Upcoming Events

30 March—2 April
AGGIECON IX (SF conference) at Texas A+M University, College Station, Tex. Guest of Honor—Philip Jose Farmer; Toastmaster—Wilson Tucker. Films, art show, hucksters. Info: AggieCon IX, Texas A+M University, Memorial Student Center, Box 5718, College Station TX 77844.

31 March—2 April
MONCON II (West Virginia SF conference) at West Virginia University, Morgantown, W.Va. Guest of Honor—Harlan Ellison and Stan Lee. Info: Moncon II, Student Organizational Services, Mountainlair, W.V.U., Morgantown WV 26506. (Enclose S.A.S.E.)

3—5 April
Fifth Annual Symposium on Computer Architecture (CompSoc, ACM) at Palo Alto, Calif. Novel and recent development on all aspects of computer architecture. Info: M. Danielle Beaudry, Publicity, Digital System Lab, Stanford University, Stanford CA 94305.

14—16 April
MARCON 13 (Ohio regional SF conference) at HoJoMoLoNoColO [Howard Johnson Motor Lodge North, Columbus, Ohio]. Guest of Honor—A. Bertram Chandler; Fan Guest of Honor—Larry Smith and Bob Hillis. Registration $6 until 1 March, $8 thereafter. Art show, films, hucksters, banquet. Info: Ross Pavlac, 4654 Tamarack Blvd, C-2, Columbus OH 43229.

28—30 April
DUBUQUON (Iowa SF conference) at Julien Inn, Dubuque, Ia. Guest of Honor—Algis Budrys; Fan Guest of Honor—Ken Keller; Toastmaster—George R.R. Martin. Registration $5 in advance, $7 at the door. Info: Gale Burnick, 2266 Jackson, Dubuque IA 52001.

30 August—4 September
IGUANACON (36th World Science Fiction Convention) at the Hyatt Regency, Phoenix, Ariz. Guest of Honor—Harlan Ellison, Fan Guest of Honor—Bill Bowers, Toastmaster—F.M. Busby. Registration—supporting (Hugo voting and reports) $7, attending (all privileges) $20. This is the big one when all the SF family gather. Panels, talks, films, masquerade, art show, hucksters. The Hugo Awards and the John W. Campbell Award for Best New Writer will be presented. Selection is made by members of the convention so join and get a chance to vote. Info: Iguanacon, Box 1072, Phoenix AZ 85001.

ANTHONY R. LEWIS

Items for the Calendar should be sent to the Editorial Offices, ***four months*** *in advance of the issue in which you want the item to appear.*

Solly transferred his attention from the sky to her chest and knew his defenses were falling. Bosomy. She had long brown hair hanging to her shoulders, and many freckles on her face. Country girl, maybe. A country girl with a blonde wig, a red wig, and a pair of white boots in her bag. "Stacked deck," he repeated weakly. "What am I going to do?"

"Play with me," she said quickly. "I can fly you right out of this world."

"Two minutes, citizen Paro. Shall I reject her?"

"This is a crooked game!"

"Look at my pretty teeth, Loverpops. All yours to play with."

"Make a decision immediately, citizen Paro."

"This is dealing off the bottom!" Citizen Paro found himself looking at Stevie's fine white teeth, but he wished she would stop talking about them. He asked desperately: "Do *you* know what kind of meat they put in Syracuse stew?"

"Oh, yes. It's cat, or dog, or 'possum, depending upon the local availability. Do you want some?"

Solly fell back in dismay, upset by the revelation, but the girl mistook his backward motion for an invitation and popped through the doorway. As soon as she was inside she scanned the room and then cried out her pleasure.

"*Pink*. You have a pink house! I love pink, I'm really mad about pink. I wish I had a pink house like yours. Is the bedroom pink? Oh, I hope so! And the bathroom? This is pretty. I love it. My house is sort of blue. I don't really like blue at all, but there wasn't anything else vacant. Look at this—pink all over! I hope I can have this house when you leave."

Solly tried to say: "I don't—"

She discovered the lighted television screen and the bill of fare. "Dinner! You're ready to order dinner, but you waited for me. Oh, I *love* you. Please close the door and order dinner. I'm starved, I really am. Tell them to send lemonade, *lots* of lemonade. I'm fond of lemonade, I drink just liters every day. You'll be *very* surprised when you learn what I can do with lemonade. I brought the vitamins with me, Loverpops."

Solly tried again: "I don't know what—"

But she left him quickly, darting around him to run to the bedroom door and peer in. "It *is* pink. A lovely pink bedroom! What fun—what real fun we're going to have here. I do my very *best* in pink bedrooms, I really do." Stevie clapped her hands with delight, and then went on to inspect the bathroom. Her happy shriek filled the house. "And this is pink! Oh, I want this house, I want it, I want it! Dinner and lemonade in a pink house—and then some pink fun in a pink bedroom. Hurry up, Loverpops! Please hurry. Order dinner, and just as *soon* as we eat—well, *you* know what follows. And after *that* I'll surprise you all over again."

Solly Paro looked out at the metal patrolman waiting in the dusk. He said sourly: "This is the last damned time I order up a broad from *you*."

"Good talker, childlike," the robot replied. "Do you accept the female, citizen Paro? One minute remaining."

"What choice have I got now, eh? It's the only game on the block." And he slammed the door on the many staring eyes.

Solly Paro was exhausted. Toil-worn. He lay limply on a sofa in the leisure room, a truncated sofa much too short for his lanky body. His legs and feet dangled over the end, and if he had the strength remaining to stretch them, he could have touched his toes to the floor. Solly was too tired to do much of anything but sprawl there and contemplate the pink ceiling.

Dinner had been an almost-success—cultured chicken washed down with lemonade—and the leftovers together with the plastic dishes had been air-flushed down the garbage disposal bin. Stevie had not stopped talking during the meal. She had told him again and again how much she adored the pink house, how much she wished it was hers, and how she was determined to ask for it after he vacated. He'd said that he didn't plan to vacate, but she ignored that and prattled on. She promised him a thousand and one delights and then assured him that she *did* know a thousand and one; she kept hinting of a great surprise later on in the night, and then asked him if he wanted to play poker, or something, before the pink bedroom. Solly Paro said no.

He blinked at the pink ceiling and shook his head once or twice before fatigue cautioned him to stop that.

After a while the sounds of the shower stopped. Stevie began to sing as she toweled herself.

Solly supposed the lemonade did that for her. He had ordered a copious supply for their dinner, and now several sealed glases of the drink remained on the table. He'd been astonished at the stamina and the inventiveness of the girl—of a nineteen year old country girl, if her claim and his supposition could be trusted. And now she was singing after a shower, while he just sprawled there exhausted. Lemonade.

"Look, Loverpops!"

Despite the fatigue, he had to raise his head to stare when she danced into the leisure room. Stevie smiled warmly at him, showing him the teeth, and opened yet another plastic glass of lemonade. "Oh, good," she said.

She was wearing the blonde wig, white boots, and a film, flimsy, pinkish *something* that was artfully short and totally transparent. The blonde hair fell to her shoulders and curled against the flesh of her neck, the white boots extended a hand's length above her knees, while the flimsy *something* hung over her breasts but failed to cover her dorsal cheeks.

Solly's head fell back on the sofa. "You're stacking the deck again!"

Stevie peered down at him, quickly solicitous. "Loverpops, you can't quit *now*. You haven't got your money's worth."

"Oh, lordy, lordy . . ."

"But you haven't, you really haven't. Look at me, just *look:* I'm all fresh and sparkly and ready to go. I feel pink. Bedroom pink. Do you want to know my secret? I have a secret, I really do, and none of the other girls know it. I take vitamins and drink liters of lemonade. I really *do,* Loverpops. And it does *this* for me." She danced about the room, swirling first away from him and then back again, while the flimsy garment sailed high about her body. She ended the dance beside the sofa, by making a little leap into the air and clicking the boot heels together. "See? Out of this world—I'm going to blast you right *out* of this world."

Solly found himself staring at the tops of the white boots and shut his eyes. He wanted to groan or sigh or express his exhaustion in some audible manner, but pride closed his lips. And already something was beginning to stir at the capering, pirouetting sight of her.

Stevie dipped into the overnight bag and brought up a vitamin bottle. She rattled the contents in invitation but Solly kept his eyes shot and ignored the offering.

Stevie unscrewed the cap, watching him carefully. She pried loose one capsule firmly fastened to the underside of the lid, and then rattled the bottle again to catch his attention. She squinted at the label on the bottle.

"Just listen to this, listen to all these goodies: palmitate—that's vitamin A, and ergocalciferol—that's vitamin D, and then ascorbic acid and sodium ascorbate—that's C, and thiamine mononitrate is B-1, and pyridoxine hydrochloride is B-6, and the potassium—"

"Stop!" Solly commanded. "Stop all that."

"But there's lots *more,* Loverpops. Lots of minerals and things. Vitamins and minerals and lemonade, that's my secret recipe. I take them all the time and I can dance and play and sing and *do* things—you know, bedroom things." She looked at the walls and then up at the ceiling. "This pink house, this beautiful, beautiful pink house! Would you like me to stay with you all the rest of your life?"

"I wouldn't live so long!" Solly opened his eyes and rolled his head to avoid staring at the boot tops and the flesh above them. "Please sit down. Sit down someplace. I can't rest with you jumping around like that."

Stevie promptly sat down on the floor beside the sofa. "I'm going to wait right here for you, Loverpops." She was so near he could smell the scented talc on her body. "Do you know what I want you to do? Can you guess? I want you to *think* about what you want to do *next.*" She giggled, and then put the vitamin bottle in his hand. "Hold that for me."

Solly looked at the bottle and then back to her.

Stevie showed him the vitamin capsule in her fingers, the large brown gelatin capsule she'd pried loose from the underside of the jar lid. "See? Here's to our *next* time, Loverpops—

just as soon as you're ready. Bigger and better than ever!" She popped the cap into her mouth and washed it down with a large swallow of lemonade. "There, now, I'm fit and fiddling. *Wink* when you're ready."

"Lordy," he said again. "All that on vitamins."

"And lemonade. It never fails me."

He stared at the tantalizing bosom so close by and then looked down at the open bottle in his hand. "What would they do for me, eh?"

Stevie grinned suddenly, a sly and wicked grin that telegraphed her answer and almost made him wish he hadn't asked the question. She leaned toward him, thrusting the big girl's chest into his face, and whispered: *"Stiff,* Loverpops. They'll make you stiff."

Solly supposed he would have blushed if he hadn't been so damned tired. He tilted the bottle and let two capsules fall out into his hand.

"They look like horse pills."

"I've never seen a horse," Stevie said. "What is a horse pill?"

"A big pill you feed to horses to make them win or lose a race." He put one of the capsules into his mouth and rolled it on his tongue. "I don't taste anything."

"But there isn't any taste, Loverpops. When they get down into your tummy they dissolve and let all the *things* out, the vitamins and minerals and things I was telling you about." She gave him the remainder of her glass of lemonade. "Do you need to wash it down? Lemonade has citric

acid in it—I guess that's what makes it so tart."

Solly Paro gulped down the capsule but needed all the fluid in the glass to wash it clear of his throat. It wanted to stick half way down. He dropped the second cap back into the bottle and rested his head on the sofa. Even the effort of raising his head was tiring.

"Maybe one will do it, eh?"

"Oh, yes, one will *do* it, Loverpops."

"Stop calling me that! My name is Solly Paro. Call me Solly."

Stevie took the bottle from his hand, replaced the lid, and got to her feet. She crossed the room for yet another glass of lemonade from the table, and dropped the bottle into her overnight bag. The girl took a few sips from the glass and braced her hip against the table.

"I think we should stop telling these little white lies. I really do. We shouldn't tell little white lies in a pink house."

Solly said: "What the hell you talking about, eh?"

"Little white lies," she replied. "I told one and you told one. I'm not really nineteen years old. No, I'm not. I look like I'm nineteen, but I'm really twenty-four. Men *like* me to be nineteen and *that's* why I tell a little white lie—just to please them. I do. And your name isn't Solly Paro. It isn't. Your I.D. is a forgery. Your real name is Charlie Harris, and you're on the run from Vegas. You ran out on a debt. You really did."

Despite his fatigue, the man shot bolt upright on the sofa. He managed only a sitting position but rising alarm demanded he be on his feet.

"What the hell? What the hell goes on here?" And he tried once more to get to his feet. "What do you know—" His breath was painfully short. Abruptly, to his surprise and consternation, he collapsed onto the sofa and was unable to raise so little as his head or his hand. "What—"

"I'm really Stevie," Stevie said. "No more little lies. I'm really twenty-four years old, and I know how to make men happy. I work for the Family. *All* the girls do, but I make more money than they do—I'll do anything. Really, I will. Now, you: you cheated the Family out of some money—oh, a *lot* of money, Charlie Harris. You borrowed *all* that money from the Family in Vegas, and then ran away without paying it back. And then you came to Chicago, and you called for a girl, and they *found* you. They did. I guess I'm a sort of collection agent for the Family, Charlie Harris. And you're a dead man."

The inner lining of his stomach was afire.

Stevie leaned against the table, watching him closely and studying his labored breathing.

"Potassium cyanide and lemonade, Loverpops. It *will* send you. It really will. It always works. Potassium cyanide isn't so much by itself, I don't know *what* it will do by itself, but when it mixes with the lemonade in your tummy it turns to—" Stevie stopped talking, looked down at the

sofa, and then moved nearer to examine the man.

"—it turns into prussic acid." She completed the sentence, but was aware that she was talking to a corpse. "Thirty or forty seconds if you're lucky, Loverpops. I guess you were lucky."

Stevie carried the glass of lemonade and her bag back to the pink bedroom and stripped off her working clothes, to dress for the street. She stowed away the blonde wig, the transparent garment, and the high white boots into her overnight bag and made ready to leave. Because she liked tidy things, she made the bed. Without looking at the body in the leisure room she went directly to the front door and rapped on it with her knuckles.

"Open up, officer. This is Stevie."

The lock turned from the outside and she pulled the door open. The robot policeman loomed large in the night. One tinted plastic eye looked at her while two others examined the body draped over the too-small sofa.

"Is citizen Paro defunct?"

"Oh, yes, he truly is. You should let the cleaning crew find him in the morning, and then *do* whatever you do."

"Those are my instructions, citizen Stevie." The robot sentinel wheeled back from the door. "Your car is still waiting at the intersection."

"Good, that's good. Will you go with me? I'm *afraid* of the dark."

"I will accompany you."

"Thank you—and I want to make a request, an *official* request. Please file it. When this house is vacated tomorrow, I'd like to have it. It's a pink house, a very beautiful pink house, and I've *always* wanted a pink house. Will you file my request for it?"

"The request has been filed. You will be notified if the dwelling is assigned to you."

"Oh, I hope so! I really do. It's so *pretty*." Stevie pulled the door shut behind her and they were in darkness. She walked along the narrow street beside the block patrolman, sipping her lemonade and beginning to build pink dreams of the new house. JJ Avenue was silent but for her footfalls.

A private car waited at the corner, empty but for the driver.

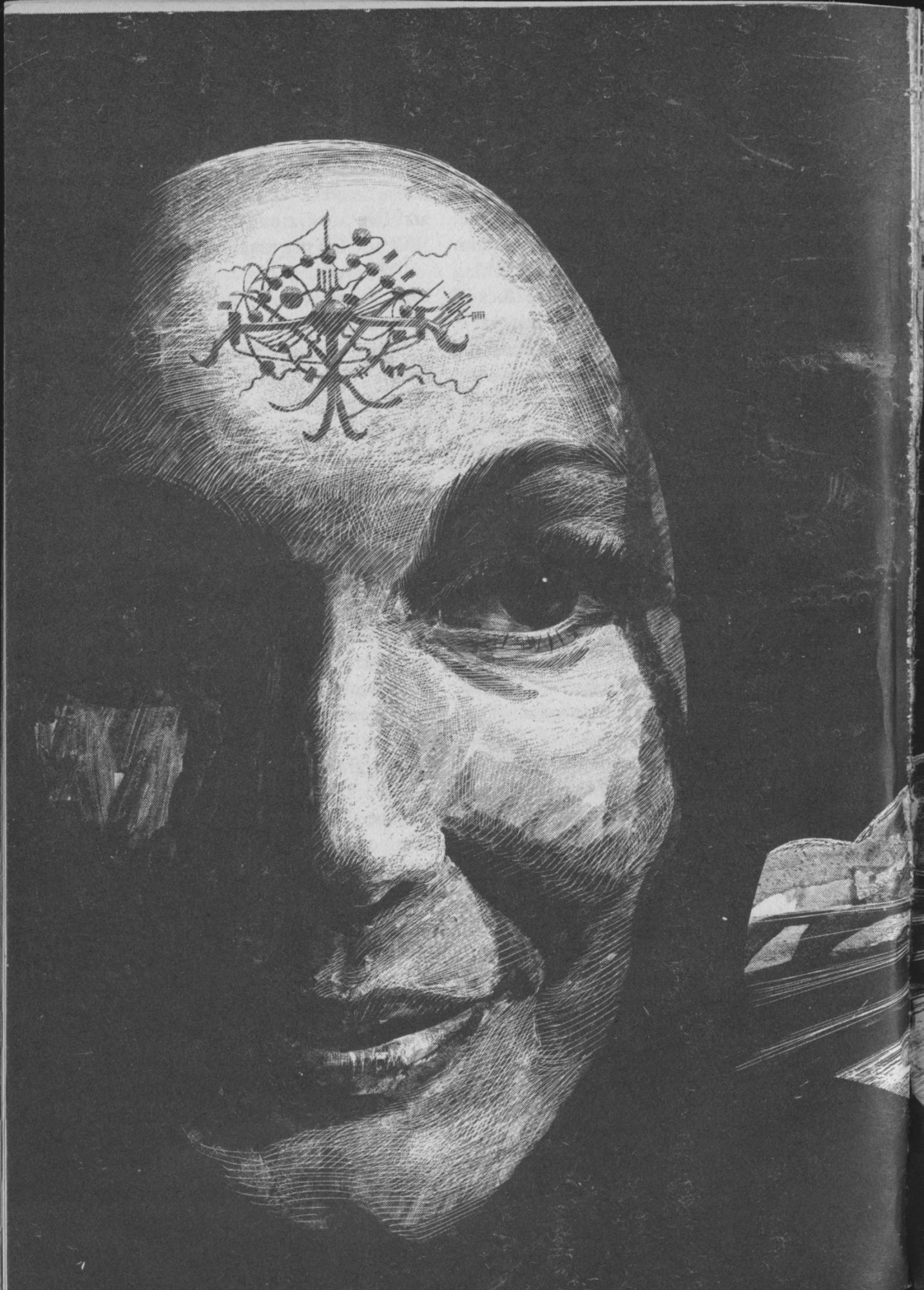
Another patrolman waited just across 250th Street, the guardian of the uptown block. That robot had raced down to the intersection when the door of the pink house opened and spilled light into the street. Some of its eyes watched while Stevie climbed into the car and put down her bag, taking care not to spill the lemonade.

She said: "Bye, bye, now. Don't forget."

"Remove your vehicle and deliver the passenger to her destination, citizen driver."

Citizen driver said: "Reap rust," but promptly put the car into motion. He drove east toward the lake.

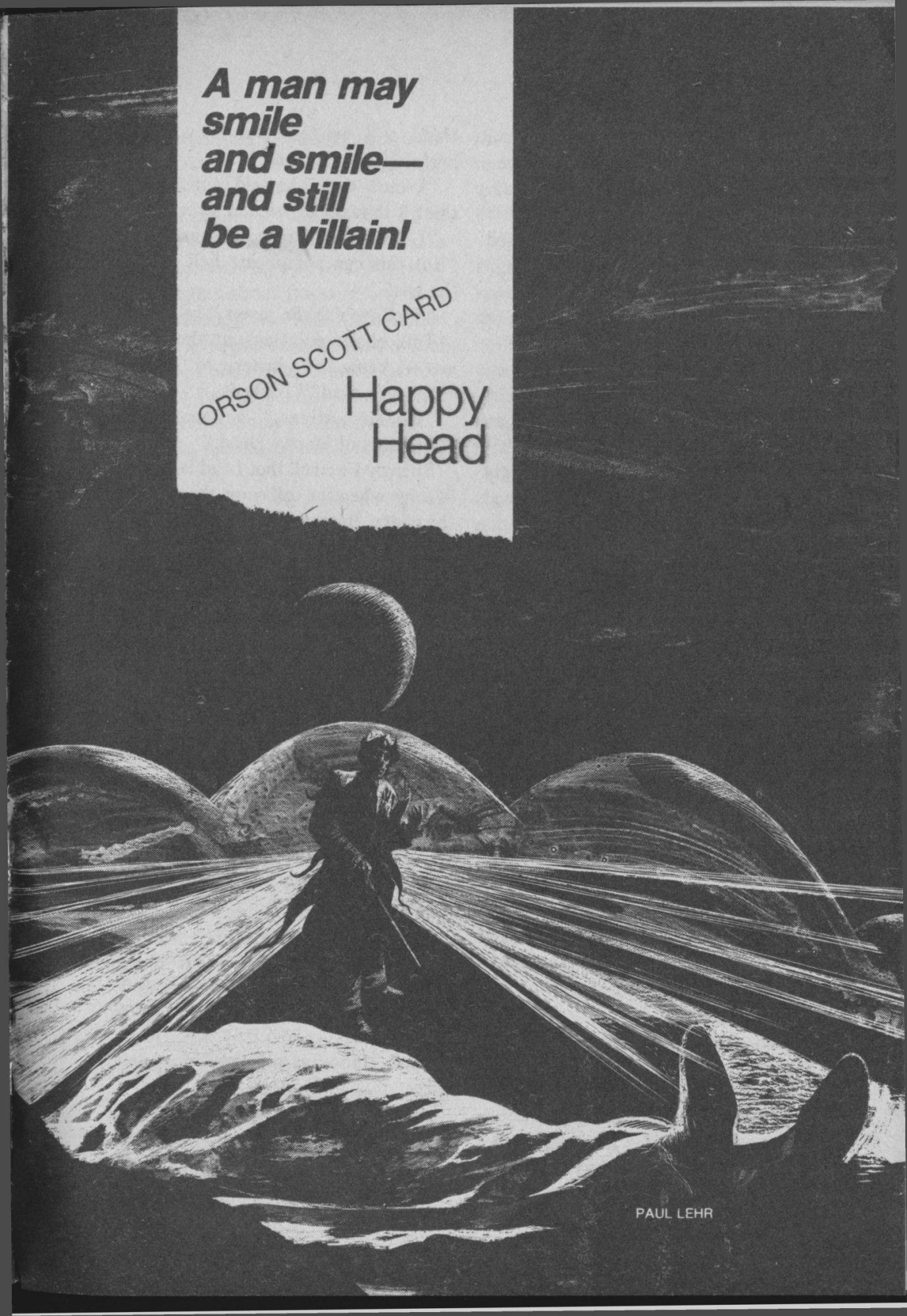
Both patrolmen rolled away from the intersection to station themselves in the exact center of their respective blocks. The several eyes maintained a constant vigilance over JJ Avenue, ever alert for evildoers. ■



A man may smile and smile— and still be a villain!

ORSON SCOTT CARD

Happy Head



PAUL LEHR

I got into Salt Lake City at 5:00 a.m., tired from a stiff ride on the airplane and only three hours of sleep anyway. Lieutenant Kimball of the SLCPD met me at the airport, and I managed to smile.

He didn't.

"Juster Benson," he said as soon as he was sure I was the right man, "to you people in the capital at Winnipeg this is probably just small time, but this is big around here, and we need an answer to give to the press. Fast."

I sighed silently. Murders were ugly enough without the problems involved when famous men died.

Lieutenant Kimball kept filling me in on how important the case was—neglecting to tell me even so much as who had died—as we flew in a police skimmer to the city of Granger, second largest in the state of Utah, though no one can really tell where Salt Lake leaves off and Granger begins. Merrill Motors is the city's chief industry, since they still lead the field in the manufacture of hydrogen motors and passenger skimmers, and I assumed that the murder was somehow connected with Merrill.

Wrong. We passed right by the airlot where Merrill employees parked fourteen stories deep, and went on to a much smaller building. Happy Head, Incorporated.

And suddenly I woke up. "Happy Head?" I asked, incredulous.

Lieutenant Kimball nodded. "I told you it was important."

I almost laughed. "Important hell," I said. "I hardly knew that Happy Head still existed. But they make *prebrains,* Lieutenant."

"I know that," he said, annoyed to think I thought he needed to be told.

"I know you know," I answered. "But this can complicate hell out of the trial."

"Well, you're the juster," he said.

Talk about pointing out the obvious—I *know* I'm a juster.

"Who's dead?" I asked.

"Rodney Miner," he answered. "President of Happy Head."

Silently I wished that I had been out of town when the call came through on the coder. But when they called, I was home, and a juster can't let sleet nor snow nor gloom of night and all that. Justice must be done.

But Happy Head, of all places. They *invented* the prebrain, and even though IBM, Xerox, and AT&T now dominated the market (did Happy Head even manufacture anymore?), Happy Head, Incorporated, still held all the patents. So Xerox's $27,000 economy model prebrain with the photographic full-color recall feature and IBM's DoubleMind Masterplex prebrain which sold for over $200,000 a whack and AT&T's ThinkSpeak prebrain with the long-distance quick-speak feature which was sweeping the country at only $49,000 each—all of them paid tidy royalties to Happy Head.

And Happy Head's president was dead.

I stroked the buttons on my magic hand all the way into the building. After all, it was Happy Head's sci-

entists who had developed the technique that kept me employed at a reasonable salary.

And suddenly I realized that I had inadvertently switched *my* prebrain to total recall on Happy Head. No wonder thoughts about the company kept racing through my head! I switched over to an undercurrent memory of the New York Philharmonic's performance of Barber's third piano concerto, and immediately I calmed down. A juster has to remain calm, and music did it for me.

"This way," said a clerk, and so we went that way.

And finally came to a very ordinary hundred-thousand-dollar office—just what you'd expect from a man who had become very rich without acquiring any taste along the way.

"This is Mr. Miner's office," Lieutenant Kimball said. A youngish man, about two meters and thirty kilos (who can estimate how much skinny people weigh?) stood up behind a desk and said, "Are you the juster?"

"Juster Benson," I introduced myself, offering my left hand. My magic hand—and he punched the query pattern on my terminal buttons. I have a neurotic feeling that I can sense the transmissions from my magic hand to Winnipeg and the answer coming back. I can't really, of course. But I still tingled.

"Satisfied?" I asked.

"Completely," he answered. "I'm Sally Wand, Mr. Miner's secretary and friend."

So Miner was gay. Oh well, I thought. Odd that during the government's tremendous Repopulation Program homosexuality was still legal. None of my business, though.

Sally Wand, dressed fit to kill in a tweed suit that came tight at his knees, led us into Miner's office. Of course the body was still there—with a juster coming, no one had dared touch it.

Miner, nearly bald and vain enough not to have done anything about it, was lying slumped over his desk. His right hand was lying on the button that apparently buzzed Sally in the outer office. A tremendous amount of blood had already dried on the floor, on the desk, and on Miner's body. It had apparently all come from a dagger that still stuck through his throat. Whoever had stabbed him had not had to use much force—the blade was sharp. And the murderer had stood just behind and beside Miner—close. Miner must not have known what was coming, though he surely knew that the murderer was standing that close. Someone known and fairly trusted, then.

It was easy to see where the dagger had come from. The walls were lined with a collection of primitive weapons—blunderbusses, sabers, M-1s, blowguns, and so forth. A hook at easy eye-level was empty. It undoubtedly had held the dagger.

I continued to gaze around the room, and then closed my eyes and shifted to the recall mode. Justers are required to have an IQ of at least 150 *without* their prebrain. But we're giv-

en some extras that even IBM's DoubleMind can't legally offer. Besides the hardware in my magic hand, I have an anomalizer judgment center that spots discrepancies and illogic. As I recalled the room in minute detail, the anomalizer hunted for anything that didn't seem right. Nothing, at least nothing I was prepared to notice yet.

There are a lot of misconceptions about justers, by the way, one of the silliest being the idea that our brains are completely replaced by microcomputers. That's nonsense, of course—we use our own brains with a prebrain implant, just like everyone else. After all, the same facts that make prebrains desirable for laymen make them desirable for us: the human brain is still the most efficient memory storage unit around, and no computer has yet been developed that can duplicate human personality, common sense, emotion, and all that.

All that a juster's prebrain does is what everyone else's prebrains do: it sorts out information as it comes in from the nervous system, and routes it into the brain's memory storage system in an organized fashion, according to various categories inherent in the prebrain. Where the unaided brain "loses" memories in the labyrinth of RNA throughout the millions of brain cells, the prebrain organizes everything for total recall, and cross-indexes it by subject, person, chronology, and relative importance.

A juster simply has some extra equipment. Like the anomalizer. And, of course, that most coveted of all devices, the sympathizer.

Coveted, that is, by anyone who doesn't have one. I, for one, am rather sick of tramping around inside other people's memories, and if I didn't believe that my work was important, I'd have given it up long ago. But as long as there are justers, I'll be one, because I have the arrogant idea that I use the power more impartially and justly than a lot of other people would.

When my examination of the office was complete, I opened my eyes again and turned to Lieutenant Kimball.

"You can get rid of the body, now."

Sally the Secretary gave a little moan. "Let me take the body, please," he murmured. The Lieutenant patted the man's shoulder. "I understand, Mr. Wand," he said, "but the widow has that responsibility."

"The bitch," Sally Wand said, his eyes filling with tears. "What the hell did she ever mean to *him*!"

"The law says," Lieutenant Kimball began, but Sally interrupted, coming to me with a terribly fervent look in his eyes. "Juster Benson," he implored as I wondered whether I'd hit him if he tried to cling to my hand. "Do I have to let that *bitch* take his body?"

"That's really not my jurisdiction," I said, and then set to work. Things might be simpler, of course, if the law didn't forbid me to sympathize directly with contributing witnesses. But as long as I had no grounds for thinking

someone was a material witness, I could only ask questions and get answers verbally.

"Mr. Garrett," I began, and I suppose my tone of voice must have conveyed the idea that serious work was beginning, because Sally stood up straight and became the cold, efficient secretary once again. "Mr. Garrett, who discovered the body?"

"I," he answered.

"And when did you last see Mr. Miner alive?" Down the list we go.

"At four o'clock yesterday afternoon. He came in from a visit with Gilbert and Sons—they're our auditors—and he went straight into his office. At five-fifteen he started buzzing me. I mean, the buzzing began and didn't let up even after I picked up the telephone. So I went into the office and found him like this, with his hand on the buzzer."

Lieutenant Kimball interrupted. "We disconnected the wire, Juster Benson, because the buzzing was driving everybody crazy and we didn't want to move his hand."

I smiled my approval, with just enough coldness that a reasonably clever person would know that I didn't want him to interrupt anymore. Kimball was reasonably clever. "Go on," I told Sally.

"Well, that's it. I called the police."

"Were you in the outer office the entire time between Miner's arrival and your finding the body?"

"The whole time," Sally answered. "And my assistant typist, Billie Parks,

was here with me. She never left and neither did I."

I glanced at Kimball, who said, "Billie Parks agrees with that. They were both here the whole time."

"Well, then," I said, "you'd know who got into and out of his office then, wouldn't you?"

"Of course," Sally answered. "There's no other way in—not even a window. Mr. Miner never liked looking out at all the buildings. He always complained about how ugly and industrial Granger is. He's a very artistically sensitive man."

I refrained from pointedly glancing at the pinstripe wallpaper with those totally out-of-date Picasso prints. Instead I asked, "Who came in, then?"

"Just three people," Sally told me. "John Cannon—he's Mr. Miner's personal attorney and also a good friend, and he usually acts as attorney for Happy Head, too. And then Darrel Schmidt, the executive vice-president, of course; and Dr. Herman Young."

"And who's he?" I asked.

"Oh, he's the head of research. He headed the team that invented the prebrain seventeen years ago next Friday."

"An anniversary that you commemorate lavishly, I'm sure," I said.

Lieutenant Kimball laughed. "It's bigger than Christmas or the Fourth of July, here at Happy Head."

"I don't see that it's particularly funny, Lieutenant," Sally said archly.

"Anyone else?" I asked, trying to keep us on the subject.

"No one," Sally said.

"And I've already arrested the three of them as material witnesses," Lieutenant Kimball added. My respect for him went up immediately. With the lawsuits that can result from illegitimate arrests of material witnesses, most local law enforcement people are more than happy not to arrest anybody until the juster came—in murder or confession cases, anyway. Fortunately, justers are never called in on anything else, except an occasional kidnapping.

"Good," I said. "I'll commend that, Lieutenant."

He tried not to look pleased.

While Kimball was involved in concealing his pleasure, a woman with close-cut hair stormed into the office. She was wearing a microdress that showed off her figure rather stunningly—but the utter lack of make-up and the mannish way she walked contrasted rather sharply with the costume and its contents.

"Are you the juster?" she snapped.

"Juster Benson," I said, offering my magic hand for confirmation. She waved it away. "Juster Benson," she said, "I have been detained as a material witness, and I want you to know that unless the arrest is immediately declared void I will bring a lawsuit that Salt Lake County will not soon forget!"

"Who the hell are you?" I asked quietly.

"Darrel Smith," she answered. "Executive vice-president of Happy Head. Do you realize what this investigation is doing to our company? The

police won't let me leave the building, so that not only is Miner dead, but I can't even go and keep his appointments!"

She was a good deal shorter than I am, but I still felt as though she towered over me. So I did what I always do when I feel pushed. I pushed back.

"Ms. Smith," I said coldly, "you are a prime suspect for murder. If you insist, I will change your arrest as a witness to arrest as a suspect."

"You have no grounds!" she shouted.

"I have plenty of grounds," I answered. "One of them being an obviously hostile attitude toward a juster who is merely pursuing his duties with a murder case."

She cooled off immediately. "I'm—sorry, Juster—Benson? Benson. It's just that this company means a great deal to me. We were the first, you know. We still have the finest research facility into prebrain enhancement in the world, and I just don't want to see Happy Head's reputation ruined. I love this company, Juster Benson. Very dearly."

At which Sally Garrett snapped a word that implied that Darrel Smith's statement might not be correct.

"You can keep your mouth shut, faggot," Darrel said.

"You wish, dyke," Sally answered. "I happen to know that you love this company a hell of a lot less than you pretend."

Darrel's face went red. "And what kind of smearing, nasty little charge are you going to try to spread now?"

Sally turned to me. "I happen to know that our little dyke here was under investigation."

"By whom?" I asked.

"By no one!" Darrel shouted.

"By Mr. Miner," Sally said, smiling. "He and the auditors found some funny things in the book. And *that* was why Mr. Miner called Darrel Smith into his office yesterday."

I looked at Darrel.

"Mr. Miner," Darrel said, her voice in tight control though her face had gone from bright red to a ghastly white, "would never do anything that might endanger Happy Head's reputation."

"Did he accuse you of embezzling?" I asked.

"No!" she shouted.

"Will I get the same answer if I subpoena the auditors?" I asked.

"Mr. Miner was alive when I left him!" she shouted. "I didn't kill him! Here, here, sympathize with me. I want you to." And she turned sideways and extended her neck toward me, so I could plug into her prebrain and tiptoe through her memories.

"No thanks," I said. "I'll pass for right now."

"Do you want her here?" asked Lieutenant Kimball.

"Just keep an eye on her until I have a chance to question the others."

And Lieutenant Kimball led her out of the room. I was alone with Sally. I knew people well enough—better than most, of course—to know that Sally

wasn't being square. He hated Darrel; that much was obvious. But he didn't hate her the way he would hate the murderer of the man he loved.

"Why don't you think Darrel killed Mr. Miner?" I asked.

"Don't I?" he answered.

"No," I said.

He smiled. "Well, well, I must be transparent, mustn't I? No, I don't think Darrel killed Mr. Miner. Because of time. You see, Darrel was in there with Mr. Miner and Mr. Cannon—"

"The lawyer?"

"Yes, Mr. Cannon is the attorney. Darrel darling was in there from right after four o'clock until about a quarter to five. She left then, but Cannon didn't. And it wasn't until nearly five that Dr. Young came, and he was in there for about ten minutes. And when he left, he just looked angry—I don't think he killed Mr. Miner."

"Interesting," I said, and for once I meant it. "That only leaves Mr. Cannon."

"True," Sally said, and he winked. "And I would have told the cops this before, but they never asked and I wanted to see Darrel arrested. You see, Mr. Cannon was still in there when I found the body."

I leaned forward on the chair I somehow ended up sitting in.

"Juster Benson, John Cannon's the only one who could have killed Mr. Miner. And that makes me rather sad," Sally said. "Because John's one of the few people around who's really worth anything. I can't think why he would have done it. And yet he's the only one who could have, don't you see?"

"What was Mr. Cannon doing when you went in?" I asked.

"That's the crazy thing. He was standing over in the far corner, going through the files, as if nothing had happened. I didn't even notice he was there until after I called the police. He must have heard me call them—I did it from Mr. Miner's phone. But all of a sudden, right out of the clear blue, Mr. Cannon says, 'Sally, Rodney and I need you to take a letter.' Just as calm as you please."

"Didn't he even mention the body?"

"Yes. He said, 'Is Rodney ill?" And when I said that Mr. Miner was dead, he just shook his head and said, 'I'm sure you must be mistaken,' and then he left the room."

"Did he examine the body? Did he look frightened? Anything like that? I can't believe that even a murderer would be so brazen about it." Of course, I knew perfectly well that murderers are perfectly capable of any bizarre behavior—including murder. But Sally seemed puzzled about it, and so therefore I seemed puzzled, too. Nothing like echoing someone else's emotions to get good answers to your questions.

"That's the strangest thing, Juster," Sally said. "Mr. Cannon and Rodney were best friends for years. They had no secrets from each other, did so many things together. I find it so hard to accept the idea that John killed Mr.

Miner—and even harder to believe the calm way he walked out of the office with Mr. Miner dead, right there."

I shook my head and clucked my tongue.

"But how could it be anyone else? If Herman Tank had killed him—"

"Herman who?"

"Oh," Sally said, smiling. "It's just what everyone calls him. Herman Young, the head of research. We call him Herman Tank, after the old Sherman tanks from the second war, you know? Because he runs right over everybody—anyway, if Herman had killed Mr. Miner, wouldn't John Cannon be the first person to speak up about it? And Darrel's *absolutely* impossible, because both John and Herman would have said something about Mr. Miner being dead. No, Juster Benson, I'm absolutely certain that it was Mr. Cannon, though God only knows why."

"Well, then, we'll just have to ask God," I said, smiling. "Thanks for your help, Sally. Where can I find this Dr. Young?"

"Research is directly down this corridor, at the opposite end of the building."

"Would Dr. Young be in?"

"He never leaves, except to go yell at somebody," Sally answered.

"Well, while I'm down there, do you think you could take a few minutes and tell the police that I want to see—" and here I switched over to recall "—Billie Parks, the auditor who knew what Mr. Miner had just found out before coming to the office yesterday, and John Cannon, of course. Could you do that?"

"Of course," Sally answered. "I don't have too much work to do right now, not until somebody takes over Mr. Miner's position." He laughed. "I'll probably be out of a job anyway. Utah isn't exactly the best place in the world to be gay, and the board of directors never did approve of Rodney's sex life. They'll undoubtedly get somebody straight to take over."

"You never know with boards of directors."

"Juster Benson," Sally said as I started out the door. "Are you sure I can't get custody of the body?"

"That's not up to me," I said as gently as I could. And then I left. I'm not gay myself, but over the years I've sympathized with enough fags to know that it isn't easy to be gay, even in these liberated days. Oh well, none of my business. I just catch killers.

I went down the hall. Past the lobby there was an obvious change—the wood paneling and thickly carpeted floors gave way to smooth plastic floors and walls, with a smell of disinfectant. More like a hospital than a research facility. But at the end of the corridor was a door labeled, "Happy Head Research Laboratories." Since the sign also said, "Come in," I went in.

The contrast with the business end of the building continued. Instead of hushed secretaries and hooded typewriters, there were four stenogs typing their fingers off loudly in a corner, while a dozen or so men and women in

white lab coats shuffled other papers and played games with computer terminals throughout the rest of a room large enough to be a barn.

There were no signs on any desks. So I asked the nearest lab-coated young woman where Dr. Young might be found. She smiled.

"He's in the Op Shop right now," she said. The smile stayed.

"What's an Op Shop?"

"It's kind of an operating room sometimes, and sometimes our model assembly room. Absolutely sterile and dust-free, you know. So that we put together our new experiments there, and then plunk them right into somebody's head without having to take the prebrains out of the controlled environment."

"You do operations here?"

"Of course. Experimental models have to be tested, of course, and we have a license to work with human beings."

"When will he be out?"

"Any time. He's trying out his latest refinement on the emotional link prebrain. It's really quite an exciting project, though I can't discuss it too freely. Industrial spying, of course. We've made the Big Three pretty rich off our patents, but they'd rather not pay royalties if they can steal something."

"Understandable," I said. "Can I wait for Dr. Young?"

"Of course, sit down. I see by your built-in terminal that you're a juster. You must be investigating the big man's death."

"Good guess," I said, sitting down on a semi-stuffed metal chair that seemed scientifically designed to feel awkward, no matter how you sat in it.

"Well, I don't know anything about it, but if you want to know the truth, Mr. Juster—"

"Benson," I said. "Juster Benson."

"Fine, glad to meet you. If you want to know the truth—oh, and I'm Donna Silberman, I'm always like that, I can never remember to introduce myself, how silly of me—"

I probably would have liked her if she weren't smiling all the time.

"Juster Benson, if you want to know the truth—"

"I do."

"There's not a soul over here in Research who isn't glad to see the old turd done in. Oh, I'm sorry he was murdered. I would have been just as happy if he had tripped over his shoelaces and fallen into an abandoned mine shaft. But we're all perfectly happy that he's gone."

I raised an eyebrow. With talky people, a raised eyebrow is as good as an engraved invitation. She went on.

"I mean, if you want a perfect motive, we *all* have one. Old Rodney Miner was cutting off the budget for the emotional prebrain—and it's the most important thing we've had here since the prebrain itself all those years ago."

"What *is* the emotional prebrain?" I asked.

"Emotional *link* prebrain. It cross-references not only by chronology,

person, subject, and importance, but also by emotion."

"I thought that was impossible."

"Well, so was flying—till somebody flew!" She laughed. When she was through laughing, her smile went on. It was beginning to drive me crazy.

"Tell me, Ms. Silberman—"

"Donna, please, no need to be formal—"

"Tell me, Donna, do you ever stop smiling?"

"I don't think so," she said, her grin broadening (which I had not thought was possible. "I'm a very happy person."

And then a loud voice boomed from across the room, "And by all that's holy, Donna Silberman, you're about to be an *unemployed* happy person."

Her grin didn't diminish. Without even looking for the source of the voice, she said to me, "That's Dr. Young."

"I'm not surprised," I answered. I stood and walked toward the man, who was walking toward me. He was toweringly tall, but the hand that shook mine was slender and long, and I realized that Young wasn't the ham-handed bulldozer he looked to be at first glance.

"Juster Benson," I introduced myself again. He glowered and took my magic hand, punched out the identification code, frowned at the answer, and then punched in another code. I was curious as to what he was finding out. So I asked.

"Your government security clearance, of course. Since this idiot here told you far too much about our work, I have to find out whether we've been compromised."

"And?"

"Your security clearance is tight enough that they'd let you sit in on the virgin birth, as long as you washed your hands. Nevertheless, I trust you won't need to investigate our current lines of research any further."

I smiled. Smiles always mean exactly what somebody wants them to mean, without saying anything at all. And it worked again. After I graced him with a slanty view of my teeth, he relaxed and favored me with a view of his. He had fine large teeth, and I surmised that he either brushed often or chewed hay.

"I suppose you're here about old Miner."

"Good work, Hercule," I said.

"Don't get sappy," he said. "It's torn things up around here, you know."

"I can see," I said, looking around at a laboratory that seemed to be running as smoothly as ever.

"Well, of course the day-to-day isn't affected, Juster, but at the highest levels—well, what about the directions for the future? We had everything worked out, Miner and I, and now—poof, all gone. Who knows what the new man's going to do?"

"Whatever he does, he'd better keep a bodyguard around while he does it," I said.

Herman Young laughed, long and loud. Utterly without mirth. I thought that his laugh would be appropriate

for the devil, if there was one. But this hardly seemed like hell.

"It's a damned shame about Miner. I suppose I'm just about the last person who saw him alive, except for Cannon. And the murderer, of course."

"And who's that?" I asked.

"If I knew, do you think I'd wait for you to ask me?"

"Not unless you were him."

"I'm not."

"Ah. I'm relieved to know that. I can go home now."

This time he didn't laugh. "Look, I know I'm a material witness because the cops told me not to leave here. Well, that's fine, I have plenty to do anyway and I had no plans to go anywhere. But if you're going to sympathize, then sympathize. Don't waste my time with a bunch of stupid questions and innuendos."

The voice had command in it, and against my will and judgment I found myself grinning sheepishly, as I always had in third grade when a particularly firm teacher had caught me playing doctor in the coat closet or some other such offense. Words of apology formed on my lips. However, I am a juster. I didn't say them.

"Dr. Young, there are really only two possible murderers. You and Mr. Cannon."

"Cannon?" he said, snorting incredulously. "He'd never lift a hand against Miner."

"Then you."

"Ridiculous. There must be someone else."

"Not possible. Was Miner alive when you went in to visit him shortly before five o'clock yesterday?"

"No, he was bleeding to death, but I had another appointment and rushed out without telling anybody. Of course he was alive."

"What did you talk about?"

"I can't tell you." He looked as if he thought only a moron would have asked.

"Humor me. Pretend that I'm a juster, and that it's a crime to refuse to answer my questions."

"Good heavens, Juster! We talked about industrial secrets!"

"You know my security clearance."

"Is it necessary to the investigation?"

I shrugged. "I can hardly know unless you tell me."

"We were talking about funding," he said reluctantly.

"For the emotional link prebrain project?"

"Damn," he said. "Damn all laboratory assistants. I had no idea the rumors were so rampant. Yes, that and a dozen other things. I wanted to manufacture them here. Miner wanted to license them."

"Why?"

"Why which? It's going to make every other damn prebrain on the market instantly obsolete, that's why. And the patent is ironclad and unbreakable. They can't get around it. So everybody—including IBM, Xerox, and that damnable AT&T—is going to have to buy them from us."

"What makes this emotional link so important?" I asked.

He looked heavenward, as if everyone should have known such an obvious thing.

"When you want to know what happened yesterday at 2:46 p.m., all you do is think that query at your prebrain, and the answer flashes out of your memory, right? Or you think of a person, and your memories of him start tumbling up. Or you think of a subject, or you scan for important things in a certain time frame, and bingo, right?"

"Right," I said.

"Well, with the emotional link prebrain, one of the features is that when you're in a mood—happy, melancholy, passionate, anything—it just takes a little mental shove, and all the similar experiences you've had—things that gave you the same kind of feeling—they all flood back. So that every time you make love, you remember the first time you made love, and every place or person you've made love with, along *with* those old emotions. When you feel proud of something, all your other achievements flash back at you, and your pride is intensified. Every pleasant emotion is tripled, quadrupled, more than that, hey? It'll sell a billion. And that ass Miner wanted to cut off the funding for it. 'It's good enough as it is, so patent it and we'll license it out.' Bull. The man has no vision. He let the damned prebrain out in the first place, and we lost billions. I don't want to lose billions again!"

"I can understand that," I said.

"It made me so damned mad."

"Mad enough to, for instance, slide a letter opener into his throat?"

"Letter opener hell. Everybody knows it was a dagger on the wall. Is that what passes for tricky questioning among you justers? Waste of a good prebrain, that is."

"You didn't answer my question."

"I was pretty damned mad. But when I talked to him yesterday, he agreed to consider a change. Why should I kill him? He was beginning to bend. You can ask Cannon, if you want. He was there. Unles he's trying to pin this on me. Did he say I did it?"

"What he tells me is none of your business right now."

With a roar of anger, Herman

Young kicked the nearest desk so hard that is slid nearly four meters before crashing into a table. The lab assistant who had been sitting at it seemed accustomed to such a thing, however. He simply stood up and pulled the desk back without comment.

"Perhaps we should find someplace private to talk," I suggested.

Young glared at me. "By all that's holy, Juster, it's my damned business if I'm being accused of murder. Right now! I demand that right now you sympathize with me and find out the truth. You'll find out that Cannon is lying, right enough!"

He offered his throat for me to hook into. I shook my head. "I haven't even talked to Mr. Cannon yet, Dr. Young."

"Then how the hell can you accuse me—"

"Dr. Young!" I said, losing patience. "I'm conducting a trial. It will go as *I* direct it, not as you do. And you *will* answer my questions and you *will* refrain from yelling at me."

He stalked away for a few paces, then turned back. "All right! What do you want to know?"

"Was Mr. Cannon in the room with Mr. Miner when you left?"

"Yes. Next question?"

"Were they involved in any kind of discussion?"

"Yes. They had been discussing something when I came in. They stopped discussing it while Miner and I yelled at each other for a while. When I left, I presume they continued discussing it."

"Thank you. That will do for now."

"Excellent. Are you going to sympathize?"

"Maybe later," I said.

"Damn!" he shouted. The walls rattled faintly. "Do you mean you intend to interrupt my work *again*? Just do it now and get it over with!"

He stared at me, rather defiantly, and I looked at him, too—trying to look cool and unruffled, but I rather imagine I failed at it. I wanted to belt him in the nose. Or *can* one belt someone anywhere but in the belt?

"Dr. Young," I said, sounding studiously patient, "If I didn't believe you innocent, I would certainly believe you guilty because of your insistence that I sympathize with you. Surely you know the law on that point?"

"You can sympathize with material witnesses, that's the law, and I'm a material witness. There's also a law that says you must act expeditiously. That means *fast,* in case you didn't know."

"I knew. However, Dr. Young, there's also a constitutional amendment that declares that a citizen can't be compelled to testify against himself. And a Supreme Court decision that declares that the Bill of Rights is still valid, even in a case where a juster can get the truth. If I were to sympathize with you, as a material witness and not as a confessing defendent, and it turned out that you were the murderer, you could not be prosecuted."

"Oh."

"But you surely knew that," I said.

"All I knew was that I'm innocent of any crime and I have a lot to do. You'll end up wanting to sympathize in the end, of course. And I suppose I'll have to let you interrupt me. In the meantime, kindly go to hell and leave me alone."

He turned quickly and stormed out of the room. As soon as he was gone, a low chuckle went up from the lab assistants. Donna Silberman came over to me.

"Congratulations, Juster," she said, grinning. "You're the first person ever to go through that and live."

Then she realized what she had said.

"Oh, but of course you know I mean he's never actually *killed* anybody!"

I reassured her that I had indeed understood her meaning. She smiled again. I noticed with relief that she was actually capable of dropping the smile, if only for a moment. A thought occurred to me—which is one of the reasons computers are unlikely to replace human brains. Thoughts don't just "occur" to computers.

"Ms. Silberman—"

"Donna—"

"Dammit, Donna, I know your name!" And the idea had left me. I cursed, and asked her something else. "Is this emotional link really important?"

"Oh yes, very. Didn't you hear him describe it?"

"Yes, of course. But doesn't it magnify the unpleasant emotions, too? When you feel sad, don't you remember every sorrow you ever had, making it a thousand times worse?"

She shrugged. "Nope. It doesn't work that way."

"Why not?" I asked.

"How should I know?" she answered. "I only work here. We just put together little pieces and steps in a process. Young puts it all together, and he knows the workings of it."

"What if he died?" I asked.

"Oh, any of us could probably figure it out in a few weeks, if we had a finished model to work with. But heaven knows what he does behind locked doors right now. He's really paranoid about industrial spies. He's certain that AT&T has smuggled some spies in here."

"Have they?"

"Of course!" she answered, and once again I felt like a moron for not knowing something so obvious.

And then Lieutenant Kimball came in to tell me that they had Cannon, Parks, and the man from Gilbert and Sons ready for questioning.

For the sake of interest and a poetic setting, I talked to them one at a time in Miner's own office. The body was gone, of course. Once I had seen it, they packed it away for the autopsy, just in case something extra was involved that the medical examiner hadn't been able to pick up with his chemical sampler *in situ*.

The man from Gilbert and Sons confirmed what Sally Garrett had told us: they had indeed caught Darrel Smith embezzling. But that really made no difference. Logically there

was no way I could see that if Darrel really had killed Miner the fact wouldn't have been noticed by Cannon or Young. I sent the accountant home.

Billie Parks, a bright young woman who explained that she was only working as a typist to pay her way through school and become a scientist, corroborated Sally Garrett's testimony. Cannon had entered the office first, followed by Darrel Smith. And after Smith left, Dr. Young had come in, stayed for five minutes. And Cannon didn't leave until after Sally had gone in to answer the buzzer.

I thanked Billie and sent *her* home. Then, alone in the office, I closed my eyes and scanned back over the testimony, with the anomalizer working. I tested each possible hypothesis. If Smith was the murderer, nothing else made sense, and the anomalizer and I agreed that Smith was innocent. Of murder, though not of embezzling.

And if Young was the killer—and he certainly had a violent streak that made it *possible*—why didn't Cannon accuse him? Well, maybe he would.

A conspiracy? Doubtful. And really, quite ridiculous. Why would a conspiracy construct a murder in such a way that *one* of their number would be suspected? The anomalizer threw the theory out.

Which left Cannon. I called him in.

Lieutenant Kimball, of course, had to remain in the room—standard policy when a juster questioned a material witness. There always had to be someone else present. Justers are too expensive to keep having to replace them.

Cannon was a small man, but his smile was pleasant and looked heartfelt, and I couldn't help but smile back.

"Juster Benson, they tell me your name is," he said.

"That's true. John Cannon?" I motioned for him to sit.

"Yes. I'm Rodney Miner's lawyer. And his best friend. Or rather—I *was*. I have a hard time remembering that he's dead."

"I daresay," I said. Cannon was still smiling. Was it a disease running through the building? Did everyone have to smile?

"I imagine it looks rather bad for me," Cannon said.

"It'll help if you tell the truth," I prodded.

"Oh, I will, Juster. I know the law, and I know the way things look. I don't understand things myself, though, and heaven knows I've been trying. You see, I can't remember Rodney being killed at all. And yet I must have been there, mustn't I?"

"That seems to be the theory."

He shook his head. "I just don't understand."

"Why not just tell me what happened?"

So he did. Sally Garrett was right again—Darrel Smith's long interview had been about her embezzlement. But I was surprised to hear Cannon tell me that at his recommendation, Rodney Miner had told Smith that he

didn't intend to prosecute her. That was news.

"What happens to her now?" I asked. "With Miner dead?"

"Well, of course, the matter's up to the board of directors and the new president. But I'm sure that they *will* prosecute. Tough luck for Darrel, I say, even if she is a dyke."

Which meant that if John Cannon was telling the truth, Darrel Smith had no motive at all for killing Miner, and every motive in the world for keeping him alive. "Did she *know* that?"

"Yes, of course," Cannon said. "Darrel's not stupid. She knew that everything depended on Rodney. And when she left, Rod and I talked about it some more. He was definitely alive. And then he got a call that Dr. Young wanted to see him, and so he had me look for some budget files while he went over what Gilbert and Sons had projected for him about costs on going back into wholesale manufacture. Something Dr. Young had cooked up. And frankly, we just didn't have the capital for it. Unless we issued new stock or something like that. And we were afraid that the buyers would most likely be one of the big Three. We just didn't see a way out of that—not legally, anyway."

"So Miner wasn't just being stubborn about wanting to license out Dr. Young's new prebrain?"

"You know about that?" Cannon looked mildly surprised. "So much for our secrets. Yes, Miner wasn't just stubborn. But Dr. Young had a hard time accepting that. He just doesn't understand business. He doesn't realize that capital has to come from somewhere, and that you don't get it for free."

In spite of myself I discovered that I liked Cannon. He was a gentleman and a gentle man, soft spoken and yet warm. He didn't stop smiling, but it didn't irritate me as it had when Donna Silberman had grinned her way through a half hour. And yet everything that Cannon said removed suspicion from others and replaced it firmly on himself. A mad course, a foolish course—and Cannon seemed neither mad nor foolish.

"Mr. Cannon, how did Dr. Young's interview with Miner end?"

"Oh, rather amicably. Rodney told Herman that he'd try to find a way to manufacture. Of course, we both knew it was impossible—but Rodney was always a man of his word, and I knew that he would certainly try. Young would have known that, too. Certainly he seemed calm when he left."

"And when he left, Miner was still alive?"

"Oh, yes. Definitely. He asked me to continue going through the files, which I did until Sally came in—you know that Sally's real name is Brian, don't you?—and then Sally made a telephone call from Rodney's desk."

"Did you look at Mr. Miner at that time?"

"Why should I? I was looking through the files. But I *know* he wasn't dead, Juster Benson, because

he spoke to me several times, and he gave Sally permission to use the telephone."

I couldn't understand why an intelligent man like Cannon would lie about something so easily verified. "Sally says he was calling the police."

Cannon shrugged. "I listen back to that conversation, and of course my prebrain gives it to me word for word, and on the telephone she simply asked for somebody to bring over dinner for the three of us, we were working late. Right after that I asked her to take a letter, since I had found the file, and she implied that she was too involved with another project right then and so I left to get my own secretary on the telephone. When I came back in, Miner was dead. And I've looked back through my memory as much as I could, time and again, and Juster, I assure you, Miner was not dead while I was in the office."

I believed Cannon. I've been lied to so often that I'm skeptical of my own birth certificate, but I believed Cannon. He was a believable man.

So, because I believed him, I began to think in another direction. And it occurred to me that there was one other potential murderer.

"Lieutenant, could you send for Billie Parks?"

Kimball was surprised. "Didn't you just have us send her home?"

"I need her." I used my firm, don't ask any damfool questions voice, and Kimball got up and went to the phone.

"You don't believe this guy, do you?" Kimball asked me as he dialed, using a phone number written efficiently on a sheet of his notebook.

"I might. I certainly can't act as if I didn't believe him, and make an utter ass of myself, can I?"

If Kimball had any suspicion that I had already made an ass of myself, he kept it private. When he hung up the phone, he went back to his chair, saying, "She'll be right over. She's a little irritated."

"I'm sure she is," I said. Then I turned to Cannon. "We'll wait until Ms. Parks comes." Cannon nodded.

Kimball looked puzzled. "Why her? She's already told you everything."

"She's told me everything she could *tell* me," I said. "Now why don't you and Mr. Cannon go outside the office and let me think for a while?"

They went. I thought. I got nowhere.

When Billie Parks arrived she had apparently got over her irritation, and she came into the office cheerfully enough.

"Sit down," I offered pleasantly.

"Sure," she said. "What do you want to know?"

"Nothing you can tell me," I said.

She laughed. "If I can't tell you, why'd you ask?"

"I need to do something extraordinary, Ms. Parks. I've been rather foolishly following up on the obvious suspects, neglecting one who also had opportunity and, perhaps, motive."

"Me?" she asked, looking worried.

"Of course not," I said, reassuring her with my best smile. She relaxed visibly. "The person I'm wondering about right now is Sally."

"Sally?" she laughed. "Sally wouldn't hurt a fly. And that's not just a faggot cliche, Juster. Sally really is a sweet man. And he loves—loved Rodney Miner to distraction."

"Nevertheless," I said, "a juster has to examine every possibility. You see, Billie, if I happen to sympathize with the wrong person—if I happen to go trekking through the murderer's mind without a written confession *first*, then the murderer was compelled to testify against himself, and he or she goes free. So I can't get the facts from anybody right now, because the stories are so confused. I need your help."

"If I can."

"Billie, you're not a material witness. I can't legally sympathize with you unless you are."

She nodded.

"And I have no grounds to declare you a material witness. Except that I need, very badly, to go inside your head."

She stiffened. "I've already told you everything I know."

"I'm sure of it, Billie. Or I wouldn't dare try this. But if—just supposing that Sally were the murderer. There might have been a hairsbreadth of time, just a moment between the time Cannon left Miner's office and the time you actually saw the body. And I need to see how far the bleeding had progressed when you saw Miner dead."

She looked at her hands. "I don't like the idea of you going into my head, Juster Benson. I'm like anybody else. I've done things that I'm ashamed of, that I don't want you to see."

I nodded. Didn't *I* have my secrets, too? "When I sympathize with you, Billie, I don't read your whole mind unless I want to—or unless you make me. The machine doesn't do things automatically. It's still your brain and my brain. I have to get in sympathy with you, I have to think as you do, see with your memories. If you help me, I can find out what I need to know in a few moments, without seeing anything you want to keep secret."

She thought for a while, and then nodded. "If you're sure it's necessary."

I assured her that it was indeed necessary.

"I don't like it," she said. "But I also don't like murderers to get away with it. And even though Mr. Miner wasn't exactly what I'd call a nice man, I don't think he deserved to die. So I'll help."

I asked her to come over and sit by me. She did, and then pulled her collar away from the prebrain outlet on her neck.

I extended the male plug from my magic hand. The seven tiny prongs glistened in the light. She stiffened and looked nervous.

"It doesn't hurt," I told her.

"I know," she said.

"You won't even know I'm there. Just think through, just recall every-

thing that happened from the moment Dr. Young left."

And then I inserted the prongs from my finger into the female terminal on her neck, and suddenly my mind was awash with strange memories. I gasped—I always do, no matter how often I sympathize. Because suddenly I was totally disoriented. I was seeing a man leave Miner's office, but I was seeing him from a rather small female body, and I thought of him as a demigod—Dr. Young, the greatest scientist of cybercephalology in the world. But because I'm experienced at sympathizing, I was soon able to observe. For a short time, all I could see was the typewriter and the reports I was typing—in Billie's memory. But I was aware of the noise being made by Sally's typewriter, too.

After a while—about five minutes, my timesense told me—the buzzer on Sally's desk sounded. It kept ringing. I remembered—again from Billie—the surprise and then irritation I felt when the buzzer kept ringing and ringing and ringing.

"My *God*," Sally said as I watched him go to the door to Miner's office. "Does he think I'm Tinkerbell, to magically appear at a moment's notice?" I recalled laughing—and was again startled to hear myself laugh with a high, tinkling, female laugh.

Sally opened the door and went in. Immediately I heard him shout, excitedly, fearfully, "Mr. Miner!" And then, almost without a pause, the clatter of a receiver going up clumsily from its cradle.

And then, maddeningly, I recalled turning *back* to my typewriter and continuing typing the report. I couldn't hear a word being said on the telephone.

But then my (Billie's!) typing was interrupted by another shout. Sally's voice saying, "Mr. Cannon! You're still here!"

A mumbling answer from Cannon. And then he was at the door, walking briskly out. He smiled cheerfully—that beautiful, warm smile—at me/Billie, and left. There wasn't a break. Immediately Sally was at the door, his face white and ghastly, asking me to come in. I did, and felt again in memory the terrible fear and yet the morbid excitement and curiosity upon realizing that Mr. Miner was dead. I could hear Sally breathing in short gasps, as if he were taking quick bites of air before someone could take it away.

Miner had already stopped bleeding; the blood had already spread as far as it was going to. Sally couldn't have stabbed Miner after Cannon left the office.

I was disappointed. For a moment I wondered if I had been hoping Sally was guilty—but I acquitted myself instantly. I had merely been hoping that Cannon was telling the truth. I wanted so badly to believe him.

There was nothing more to be gained from Billie. I pulled my finger out of her neck. She sighed and opened her eyes. "Did you get what you needed?"

"Oh, yes," I said. "Thank you."

"Did Sally do it?"

"Sally definitely didn't kill Rodney Miner."

Billie smiled. "I'm so relieved."

"I wish I were."

She got up from her chair. "Can I go now?" I nodded. When she got to the door she turned around and asked, "Maybe there's something really obvious that you've overlooked."

"There isn't," I said.

"Weren't there any fingerprints on the dagger?"

I laughed. "Fingerprints are only left by morons on the holo. Our murderer left no trace on the dagger. The police checked that right off."

"Oh," she said, disappointed. "Well, good luck."

"Thanks," I said, and the door closed.

My course was pretty inevitable from there. I called in Sally, told him he was a material witness, which scared him to death, but when I plugged into him (and it bothered me more to see the world as a homosexual than it did to see things as a woman—perhaps because it seemed more natural to be gay than to be female!), I only found out that he had told the absolute truth.

When Sally went into the office, Rodney Miner was already dead, his dead hand pressing the buzzer. John Cannon really was in the room. Sally did call the police. John Cannon did leave, nonchalantly smiling.

In fact, it was appalling how casual and callous Cannon seemed. Was this the man that had been described as Miner's best friend? Grinning his way out of the office?

When I was through with Sally I sent him home. He was clear, and there was no more need for him. All I needed now to make a conviction and send John Cannon to the courts for sentencing was the testimony—under sympathy—of Dr. Herman Young, that Miner was alive when he left the office. Then circumstantial evidence would leave no possibility of any murderer but John Cannon.

But while the police were fetching Young from his laboratories, I found myself even more frustrated by Cannon. I still wanted to believe him. And there was a perverse sort of truth even as things stood: when he walked out of Miner's office, smiling cheerfully at the corpse and the distraught secretary who was still holding the telephone, he might very well have been doing just what he said—heading out to make a call to his secretary, without any idea at all that Miner was dead.

It was an attractive thought, that perhaps Miner was hallucinating. But even when we refuse to believe what our eyes tell us, the facts are there in our memories. And with the prebrain there is no way to lie—which is why a juster can make "perfect" judgments, barring mistakes in legal procedure, every time. No one can hide memories from himself—or from the sympathizer.

Why, then, was I sure Cannon wasn't lying? The man must be charismatic.

My reverie was, thankfully, in-

terrupted by Young's arrival. He looked less surly and irritated than before—more cooperative. Lieutenant Kimball left two detectives with Cannon in the outer office and came in to watch the interrogation with me. An officer must be present, and all that.

"Ready to sympathize?" Young asked me. "I've been thinking about it, and it has to be Cannon, of course."

"Of course," I said.

"Well, my ironic little female plug is ready for intercourse with the sympathizer," Young said, with a grin. I laughed—the joke was old enough, but I was grateful for anything to relieve the tension. Instead of having Young come to me, however, I got up and came to him. And as I passed by him to sit on his left, where the plug was, I looked him in the eye.

And stopped cold.

The moment I stopped, of course, concern passed over his face and he asked me, looking puzzled, "Is something wrong?"

Was something wrong? It was obvious what I had to do. But in that fleeting moment before I stopped, I had seen such a look of—what, relief? Triumph?—in Young's eyes. As if he had fooled me and taken himself off the hook.

Exactly the look I might expect to see in the eyes of someone who was guilty, and who knew that sympathizing would violate his first amendment rights and set him free on the technicality.

But it had been for a fraction of a second. And it was impossible. I closed my eyes and went over the facts again with the anomalizer. It was against logic to think of Young as the murderer—if he had killed Miner, why in heaven's name would Cannon risk his life to protect him? Certainly risk his reputation, since if Cannon had lied and the real murderer got off because of it, the law declared that Cannon could no longer legally wear his prebrain. And that would mean the end of any career Cannon could hope for, except perhaps manual labor, and even then a prebrain was necessary to memorize the day's list of instructions. Cannon wouldn't risk everything for a man like Young.

The anomalizer reassured me that Cannon was guilty and I was safe to sympathize with Young.

But then I went to recall mode and remembered Cannon telling me his story—his lies, I was certain. But as I heard him, watched him tell me again in memory, I was again convinced that he was honest. It was just a gut feeling, but it was real enough.

And then I laughed out loud. Of course I remembered Cannon and still believed he was honest. Because along with the memory of what he said came the perfect memory of how I had felt. It was self-reinforcing, just like Young's emotional link prebrain. You remember something along with your feelings of belief, and you believe even more.

And then I stopped laughing. Because I remembered the question I had started to ask Donna Silberman earlier in the day. And it might—just

might—make a difference.

"Dr. Young, I'm sorry. Could you step outside and wait for just a few more minutes?"

He looked even more puzzled, and this time irritated, too. Was I fooling myself that there was an undercurrent of fear? Probably. But when he had left the room, I told Kimball to get Donna Silberman for me.

He looked very puzzled and not a little skeptical. I could almost hear him thinking, does this juster know what the hell he's doing? The truth is, I couldn't have answered that question just then. But that was why we had human justers instead of computers. Because computers didn't wear pants. And sometimes people had to do a little seat-of-the-pants decision-making.

The door was still open between Miner's office, where I was waiting, and the outer office, where Cannon, Young, and the police were waiting. And so I heard the uproar when Kimball brought Donna Silberman in.

"What the hell do you need her for!" I heard Young (of course) shouting.

"I don't know," Kimball answered. "Juster wants her."

"She's not material. She doesn't know a damned thing! He's only trying to pick her brains about the Happy Head research program!"

"Don't be ridiculous," Kimball said, and by then I was at the door.

"Sit down, Dr. Young!" I shouted—louder than he, though I had doubted I could do it. "I am empowered to hold you in contempt of court for this kind of harassment of the judicial procedure!"

"Judicial procedure hell!" he shouted back. "One man with a magic hand makes a judicial procedure? I like the old way—twelve good men and true, instead of all this mechanical crap!"

At that I had to laugh. "Well, if you don't like all this mechanical crap, Dr. Young, why in the name of heaven did you invent it?"

And, miraculously, that shut him up.

Donna Silberman came into the inner office and sat down. This time I didn't need Kimball present, so I left him outside when I shut the door.

"Donna, I just need to ask you a few questions."

"Shoot." She was still grinning that idiotic grin.

"I have to confess that Dr. Young is right. I'm going to quiz you a little about Happy Head research. About the emotional link prebrain. But I have top security clearance, and I assure you that if I revealed anything I learned in confidence to AT&T, Xerox, or IBM, I'd lose not only my job, but also my prebrain itself. The whole thing."

"You're trying to tell me I can trust you."

"Yeah, that's what I'm trying to tell you."

"OK, Juster. That's fine with me. Shoot."

So I got ready to shoot. And then wondered what the hell I had called

her in for. The wrong answer to my first question, and I'd look like an idiot. Oh well, what's one more person thinking I have a gibbon brain among so many who are already sure?

"Donna, you said that Dr. Young has implanted experimental models of the emotional-link prebrain in several different people. How many?"

She shrugged. "About twenty, I guess."

"Who?"

"Crud, Juster, I don't have a list."

"No, I mean, what kind of people. Where does he get his subjects?"

"Lots of places."

"Hospitals?"

"Sometimes. Or, like, kids, or even some of the staff people."

"There's no formal group then," I said. She nodded. "You say some of the staff people. Do you know who?"

"Some of them."

"How can you tell if someone has an emotional link prebrain?"

She smiled even more broadly. "They're happy."

I laughed. "People have been happy before the experiment, Donna."

"Not happy all the time; and with the emotional link prebrain, you're happy *all* the time. Drugs let you down. Sex takes seven minutes. But the emotional prebrain is always there."

She spoke with the fervor of a missionary. And I realized that my guess might just be leading to something. "Do *you*, Ms. Silberman, have an emotional link prebrain?"

She looked annoyed. "Of course. Why else do you think I grin all the time? I just can't stop smiling."

And then she laughed. "It's really great to be happy, Juster. And when Dr. Young starts making these for the whole world—misery is over. You just have no idea, Juster. No idea at all. I just wish you could have one and be happy, too."

My cheeks hurt from watching her grin. But I thought of Young's description of the joy of recalling all pleasant emotions at once, instead of each event as it happens. And it sounded pretty damn good.

"Ms. Silberman. What happens to the negative emotions? *Why* don't you double them, too?"

She shrugged. "I don't know. In fact, I really can't think if anything bad has happened to me. Actually, Juster, I'm not a very good sample, because I just can't think of any bad emotion at all, at least not *very* bad, since I had the emotional prebrain stuck into my head. I just don't know what would happen."

Well, that was that. I thanked her for her help, and she got up to go. "I hope you don't get in trouble with Young for talking to me."

"Oh, he's just a lovable old bear, that's all," she said. "Yelling is just his way of showing affection."

Pretty funny affection, if you ask me. "Well, he did threaten to fire you when he caught you talking to me earlier today—"

"Don't be silly," she said. "Of course he didn't."

"Yes he did," I said.

"He's not that kind of man." She looked a bit perturbed—but still smiled.

"Donna, why don't you switch into recall mode? I distinctly remember him saying, 'By all that's holy, Donna Silberman, you're about to be an *unemployed* happy person'."

She just looked more puzzled. "When did he say that? He never did."

I tried to remind her. She just laughed and shook her head. "All he said was, 'And by all that's holy, Donna Silberman, I wish you wouldn't talk to people about our projects.' That's all."

It was my turn to be puzzled.

"Is that word for word?"

"Of course," she said. "I was in recall mode."

And so a moment later I had my magic finger in her neck, and I clearly heard Young's voice saying, "And by all that's holy, Donna Silberman, I wish you wouldn't talk to people about our projects."

I thanked her and she got up and left. At the door she said, "See? I told you I was telling the truth." And then she was gone. I heard Young growling as she left. And I saw Kimball come to the door and wait for me to tell him what next. I waved him away. He shut the door. And I tried to think.

What had happened was impossible. Donna Silberman and I had heard the same thing—and yet our memories were different. I couldn't deny the reality of what I had heard. But I also couldn't deny the reality of what *she* had heard. You can't lie to a sympathizer.

And now my anomalizer was as confused as I was. Very, very confused. One of its basic programs was to believe anything it got through the sympathizer—or through my mind—without question. But when two things were in conflict?

Time for help. This one was beyond me. I punched in the query code, and using my AT&T ThinkSpeak (a nickel now for old Ma Bell) I was able to get hold of our resident expert on equipment.

"Malfunction?" he asked, as my prebrain slowed down the quickspeak burst to intelligible speeds.

"Sympathize with me," I said, "and I'll show you."

He was a juster too, of course, and so we didn't require an actual physical attachment. When two justers are willing, they're able.

And he was as confused as I was by the conflicting memories.

"Is there any way Young could have made a prebrain that lies?"

"No. It can't be done. The only way a prebrain can work is to go directly to the memory, where it's stored. It'll get the truth."

"But both memories can't be true."

And I sat while he puzzled with the problem.

"Call Cannon in," he finally said, "and ask him some questions while I'm in sympathy."

And so for the denouement I became a mere transmitter. That's what

I get for not being the expert. But when I think how narrowly I avoided disaster, it still makes me sweat a little. If I had plugged into—oh well.

Question one: "Mr. Cannon, do you feel anything unusual when you try to remember, let's say, Miner's interview with Young?"

Cannon shook his head. "Nothing—except a great deal of apprehension. I remember how painful every other interview with Young has been."

Question two: "Did Dr. Young behave normally in the interview?"

"Oh, no, not at all. He was very mild. Jovial, like a great big teddy bear. He shouted a lot, but there was no sting to his words. I didn't feel tense at all."

Question three: "Did Dr. Young ever go near the weapons on the walls?"

Cannon went into recall mode and summoned up an answer. "Yes, he did. He even touched the knife there on the wall—the one that was, uh, in Rodney's throat. But he didn't take it off the wall. I remember that clearly."

Question four: "Mr. Cannon, did Dr. Young install an experimental prebrain in you recently?"

"Why yes," Cannon said. "He said it would increase my pleasure, and it certainly did. It's like getting a better grip on life. I've never been happier. I can cope with stress—in fact, come to think of it, I simply haven't *had* any stress. Until Rodney died, and even that—I feel terribly guilty about it, but it just doesn't seem real. I'm still happy."

He shook his head and laughed, that marvelous, warm laugh. "I've always been a basically happy person before, but since the new prebrain, why—I've felt no pain. No pain at all."

And the prebrain expert from Winnipeg said (and the AT&T Thinkspeak set it pounding in my ears): "Arrest Dr. Young and charge him with first degree murder. You can let everyone else go."

I was, to say the least, both relieved and surprised. "What's going on?" I asked; and because Cannon and Kimball didn't realize that I was in contact with someone outside the room, they both asked me what did I mean, even as the expert from Winnipeg said, "Don't worry about it. Just have the police seal off Happy Head, Incorporated. No one in, and no one out. We'll have a team down there in no time. And have Young put in maximum security, declared guilty, and waiting for a judge to sentence him. I take full responsibility."

And because our brains were, as usual, recording every word, I did as he said, wondering all the while how Young had pulled it off.

It was a week later, in Winnipeg, that I got a call on the coder calling me into the assignment center. I assumed it was another job, but instead I was led into a section of the building I had never been in, and was introduced to a man I had never met.

"Juster Benson," he said. "I'm Jus-

ter Coletti. I've been given permission to satisfy your curiosity."

And I recognized his voice. The expert on prebrains.

"Everything fit in with what we had here," he told me. "When we got your information, Benson, we were able to figure out what Young had done. Apparently—and now it's confirmed, from examination of his experimental subjects—he finally crossed the emotion barrier. We had long assumed that emotions were unfindable, because, like memories, they are not seated in any one particular place in the brain, but unlike memories they do not rely on outside sensation—they can't be routed into certain corrals, as we do with memories."

I nodded, trying to look intelligent. No one was fooled.

"Young found out that emotions *do* have a seat, after all. It's an energy relationship between different parts of the brain, and so it's in four different locations, each performing a completely different function at the same time that they're producing emotions. He tapped that, and built a prebrain that sorts out the different types of emotions. The positive ones it builds up like feedback between a microphone and an amplified speaker. The negative ones, however, overload a memory directionalizer—sorter, pardon me."

And from there on it was obvious. Once he had, so to speak "crossed the emotion barrier," it was a simple matter of putting unpleasant events—not just the emotion, but the whole memory—into an area of the brain that the prebrain was programmed not to retrieve from. It was so effective that a split second after an unpleasant event, a person with the emotional link prebrain could not remember that it had happened—so soon that negative emotions didn't have time to build.

"And because the brain can't cope with being unable to remember the immediate past, it avoids insanity by hallucinating. It's as simple as that. Unpleasant events are erased. Pleasant hallucinations replace them. The brain reads the hallucinations as reality because the prebrain has no alternative—the real events are programmed to be irretrievable. They're still in the brain, but lost."

And that was that. I thanked Juster Coletti for telling me, and he commended me for trusting my impression that Cannon was telling the truth and that Young was, somehow, trapping us. "It almost worked, too. With Cannon, an honest man, unwilling to lie in order to implicate Young, particularly since he 'knew' that Miner had been alive when Young left the office, the only person left to suspect was Cannon himself. If you had followed logic, Benson, you would then have sympathized with Young, his first amendment rights would have been violated, and he would be a free man today."

As it was, of course, Young was executed only four months later.

I thought the case was closed, and that I had a small but honorable part in it, until a few months ago, when

Happy Head Incorporated introduced the new Happy Head JoyBrain. The commercials advertised it to sound suspiciously like Young's emotional link prebrain. And so I made my way through the corridors of the assignment center until I could find Colletti again.

"What the hell's going on?" I asked, telling him about the JoyBrain. "I thought Young's gift to humanity would be suppressed!"

"Oh, of course," Coletti said, smiling reassuringly.

"Well, why is it free now?" I demanded.

"We tested it. And it's safe. You see, Juster Benson, people with a JoyBrain are not only incapable of remembering stress, they are also incapable of performing any act that *causes* stress. Remember how nice and cooperative Donna Silberman and John Cannon were?"

I remembered. I remembered that neither of them could stop smiling, either.

"Oh, yes, but that's a pleasant by-product of peace and happiness. We tested the JoyBrain in five cities in the United States—Ottawa, Seattle, Nashville, Phoenix, and Scranton—the five largest, and so the five with the highest crime rates."

"And?"

"We didn't allow any publicity, of course, but the crime rates *dropped*. In neighborhoods where implantation approached one hundred percent, crime *vanished*." Coletti laughed with joy. "And then we smuggled the JoyBrain across several key borders. We finally have the key to world peace, Juster Benson. And instead of waiting for death to bring heaven, people can have eternal joy during the life we actually *have*."

"It sounds perfect," I said.

"It is perfect," he answered. "Of course, for our protection we have left a large portion of the army and law enforcement agencies without the JoyBrain—some violence may still be necessary in self-defense or in defense of society. That's why you haven't been given a JoyBrain yet."

"Ah, I see," I said.

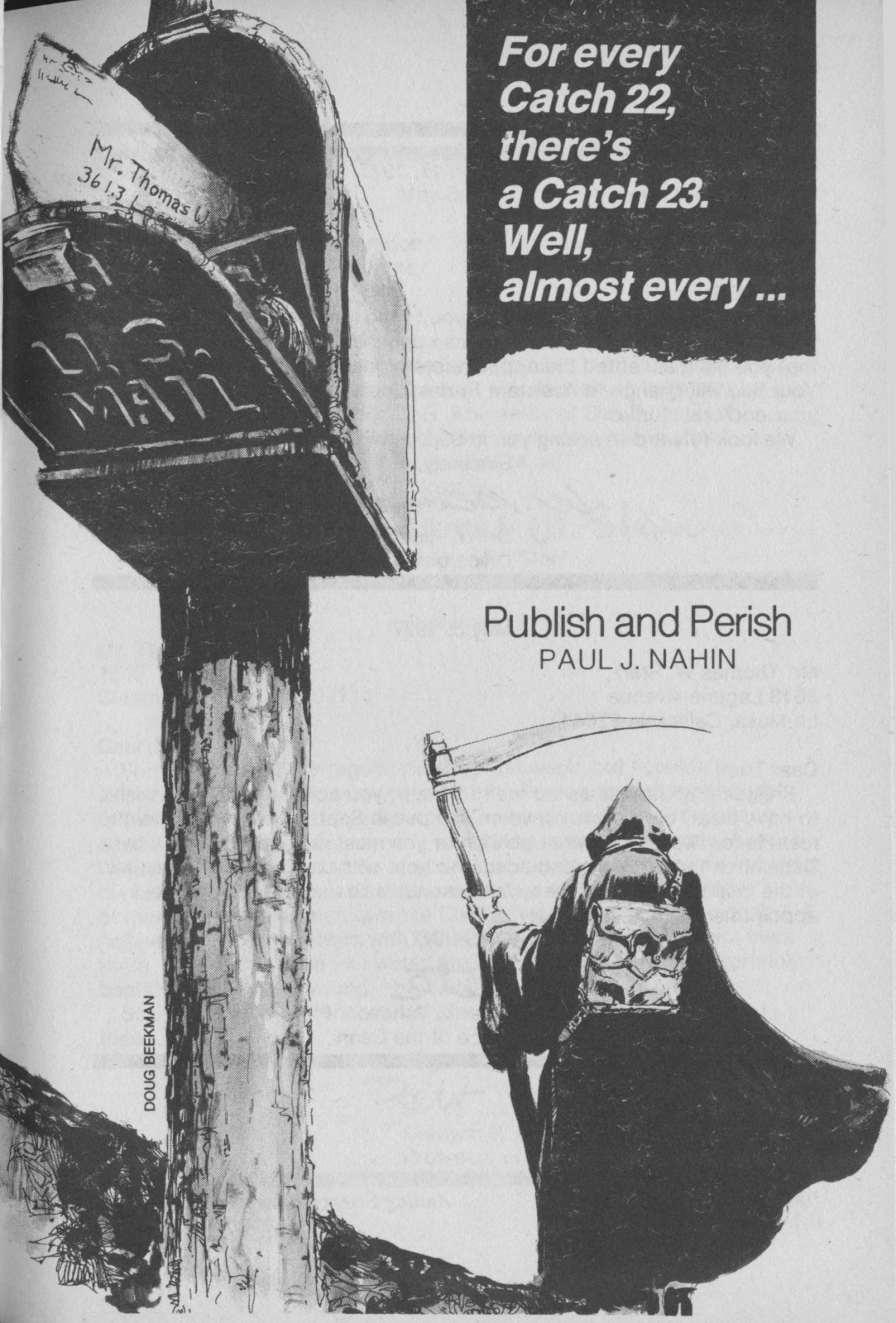
"Can you picture it? A billion people, the whole population of the world, constantly happy! Never again will war devastate us as it did thirty years ago, cutting the world population down to only half a billion or so. Never again will international rivalries keep nations from cooperating to solve the world's problems. Can you see the vision of the future?"

I saw a billion smiling Donna Silbermans, grinning until their cheeks ached, and I felt sick. But then I thought of John Cannon, and realized that there is joy—and joy.

"Yes," I said. "I can see it."

And Coletti urged me to come back anytime. He smiled at me as I left, a warm, glowing, joyful smile.

I wept all the way home, and though I tried and tried, I couldn't figure out who in the world I was mourning for. Those who had found perfect joy? Or for myself, who would refuse it, and so go unhappy to my grave. ■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MAIL
For every
Catch 22,
there's
a Catch 23.
Well,
almost every ...
Publish and Perish
PAUL J. NAHIN
DOUG BEEKMAN

March 17, 1977

Mr. Thomas W. Starr
3613 Laguna Avenue
La Mesa, California 92041

Dear Mr. Starr,

It is with pleasure that I welcome you to the Faculty of the California Technological Institute. Dean Johnson has informed me that you have accepted the appointment of Instructor in Physics. Your title will change to Assistant Professor upon completion of your doctoral studies.

We look forward to seeing you in September.

Sincerely,

W. Alden Smith

Dr. W. Alden Smith
Office of the President

May 3, 1977

Mr. Thomas W. Starr
3613 Laguna Avenue
La Mesa, California 92041

Dear Tom,

President Smith has asked me to write to you about an issue we wish to have clear, before you arrive on campus in September. Your appointment is for two years (renewable), but you must receive your Ph.D. by December 1, of your second academic year with us. Otherwise, because of the Institute's bylaws, we would be unable to recommend your re-appointment to the Trustees.

Sincerely,

Pete

Peter V. Johnson, Ph.D.
Office of the Dean

May 8, 1977

Dr. Peter V. Johnson
Dean of Engineering and Science
California Technological Institute
Claremont, California 91711

Dear Dean Johnson,

The completion of my doctorate by December 1, 1978 will be no problem. I have talked this matter over, at some length, with my dissertation advisor Professor B. B. Abernathy at San Diego Tech. He assures me there will be no difficulty. He is even joking about there being a Nobel Prize in it for the two of us!

Cordially,

Thomas W. Starr

Thomas W. Starr

September 9, 1977

Mr. Thomas W. Starr
1713 12th Street
Claremont, California 91711

Dear Tom,

Sorry we missed our regular meeting last week, but I couldn't skip the review briefing on my grant at the Pentagon (but the thought of the agony of the red-eye flight to DC almost made it worthwhile to cancel out). While losing my way wandering around the Puzzle Palace, I happened to mention some of your most recent results toward inducing nuclear fusion in water, and it caused quite a stir. If you get tired of teaching in Claremont, give the Civil Service a thought—you can't believe some of the nitwits with GS-12 and 13 ratings they've got back there. A good man like you would get snapped right up, and it certainly beats what they pay young, new college teachers.

See you next week, and we will discuss the first draft of your thesis.

Regards,

Bert

Bertram B. Abernathy, Ph.D.
Professor of Physics

14 October 1977

Mr. Thomas W. Starr
Physics Department
California Technological Institute
Claremont, California 91711

Dear Mr. Starr,

It has recently come to our attention that you have been pursuing innovative concepts on the possibility of introducing nuclear fusion in water. Your doctoral research support is funded through an Army Office of Scientific Research grant to Professor B. B. Abernathy, and as you know, we retain the right to request periodic reviews of research supported by us.

Professor Abernathy has informed us that you are now writing a thesis for open publication, based on your work. Please send three (3) copies of your draft to:

Colonel Andrew Bobble
Chief, Nuclear Security Review Office (Army)
The Pentagon
Washington, DC 20310

Sincerely,

Patricia Adams

Patricia Adams
Administrative Assistant
Nuclear Security Review Office (Army)

7 January 1978

Mr. Thomas W. Starr
Physics Department
California Technological Institute
Claremont, California 91711

Dear Mr. Starr,

After a careful study of the material you recently sent to us for review, we have classified it. Please forward all additional copies of your thesis drafts, plus any other related documents, within ten days, by registered mail in a sealed envelope within a sealed envelope.

Sincerely,

Andrew Bobble

Colonel Andrew Bobble
Chief, Nuclear Security Review Office (Army)

January 11, 1978

Colonel Andrew Bobble
Chief, Nuclear Security Review Office (Army)
The Pentagon
Washington, DC 20310

Dear Colonel Bobble,

I have read your letter to me of January 7, and I am at a loss to understand what you mean by "classifying" my Ph.D. dissertation. I have no security clearance, and at no time have I had access to classified information.

I am sure that any little details in my writing that might cause some concern by your office will be easy for me to work around. If you will send me a list of the particular issues in question, I will be glad to take them into consideration as I finish up my writing.

Sincerely,

Thomas W. Starr

Thomas W. Starr

20 January 1978

Mr. Thomas W. Starr
Physics Department
California Technological Institute
Claremont, California 91711

Dear Mr. Starr,

This letter is to inform you that there is no appeal from our decision to classify the draft material you recently sent to us. It is our final conclusion that there is no possible way to rewrite this material to eliminate the possibility of disclosing information vital to the national security of the United States. We can not transmit the list requested in your letter because such a list would be classified, and you have no clearance.

To discuss this matter further, it will be necessary for you to obtain a clearance from the Defense Industrial Security Corporation (at your personal expense), and to travel to Washington to meet with our staff. Even if you decide to do this, we must receive all information still in your possession.

Sincerely,

Andrew Bobble

Colonel Andrew Bobble
Chief, Nuclear Security Review
Office (Army)

January 25, 1978

Colonel Andrew Bobble
Chief, Nuclear Security Review Office (Army)
The Pentagon
Washington, DC 20310

Dear Colonel Bobble,

I can't believe this! You are destroying my career with all this Catch-22 crap about national security leaks that you can't tell me about because I don't have a clearance.

I have looked into getting a clearance, too. The DISCO investigation fee is $4,000! I haven't got forty bucks.

How did you get to be a Colonel? Thinking up stupid things like this? Well, you can go to hell! What I think up on my time, with my brain, is none of the Pentagon's damn business. I will finish my writing, publish it, and the Army can go screw itself.

Sincerely,

Thomas W. Starr

Thomas W. Starr

February 1, 1978

Mr. Thomas W. Starr
Physics Department
California Technological Institute
Claremont, California 91711

Dear Mr. Starr,

In response to your letter of 25 January, enclosed is a copy of Title 18 of the United States Espionage and Sabotage Acts. Release of classified information is a felony offense, punishable by up to ten years in prison, or up to a $10,000 fine, or both.

We are instructing University Microfilms not to produce microfilm xerographic copies of any unauthorized thesis you attempt to submit. In addition, we have notified all domestic and international journals of physics and/or chemistry that publication of papers by you, without any prior release, may constitute a security violation.

Please submit all documents on your research to us, as requested earlier, postmarked no later than 15 February 1978.

Sincerely,

Andrew Bobble

Colonel Andrew Bobble
Chief, Nuclear Security
Review Office (Army)

February 10, 1978

Colonel Andrew Bobble
Chief, Nuclear Security Review Office (Army)
The Pentagon
Washington, DC 20310

Dear Andy,

Enclosed are all of the documents you have requested from Tom Starr. I am taking care of all these details of transferring the water fusion work to secure, classified areas as Tom is in no shape, emotionally, to do it himself.

I know you understand the reason for his recent intemperate letter to you. He has even cut off his contacts with me, but I think he will come around in time. I am confident of his ultimate discretion and loyalty.

I am pretty sure I can handle the new classified work on water fusion for your office, but we should discuss contract funding levels on my trip to Washington next month. Take me to lunch at the Sans Souci and tell me how much you can give me!

Regards,

Bert

Bert Abernathy

December 2, 1978

Mr. Thomas W. Starr
1713 12th Street
Claremont, California 91711

Dear Tom,

I write this letter with regret. You are a talented teacher, and I believe that with time you will become an outstanding member of the academic community. Still, though the circumstances of your doctoral dissertation difficulties were beyond your control, I can not recommend the continuation of your contract with us beyond June 30, 1979. The Institute bylaws are most specific, and the failure to obtain your Ph.D. by December 1 leaves no room for an exception or waiver.

I will, if you wish, do what I can to aid you in seeking a new position for next year.

Sincerely,

Pete

Peter V. Johnson, Ph.D.
Office of the Dean

July 15, 1979

Dr. Peter V. Johnson
Dean of Engineering and Science
California Technological Institute
Claremont, California 91711

Dear Dean Johnson,

I am writing to thank you for your help in getting me a teaching job for the coming semester. Teaching freshman physics and chemistry at Contra Costa J.C. is going to be a change for me, but without a doctorate I guess I am lucky to have that—at least I won't be pumping gas or hacking a cab. I hope I can find something for the second semester.

The nature of my work in water fusion is such that the lab facilities I saw on my interview at Contra Costa will let me continue. What the Army doesn't know won't hurt me!

Thanks, again, for your help.

Regards,

Thomas W. Starr

Thomas W. Starr

December 13, 1979

Mr. Thomas W. Starr
Science Department
Contra Costa Junior College
Walnut Creek, California 94596

Dear Mr. Starr,

I am pleased to inform you of the acceptance of your paper "An interesting classroom demonstration of power from water". It will appear in our issue of February 24, 1980.

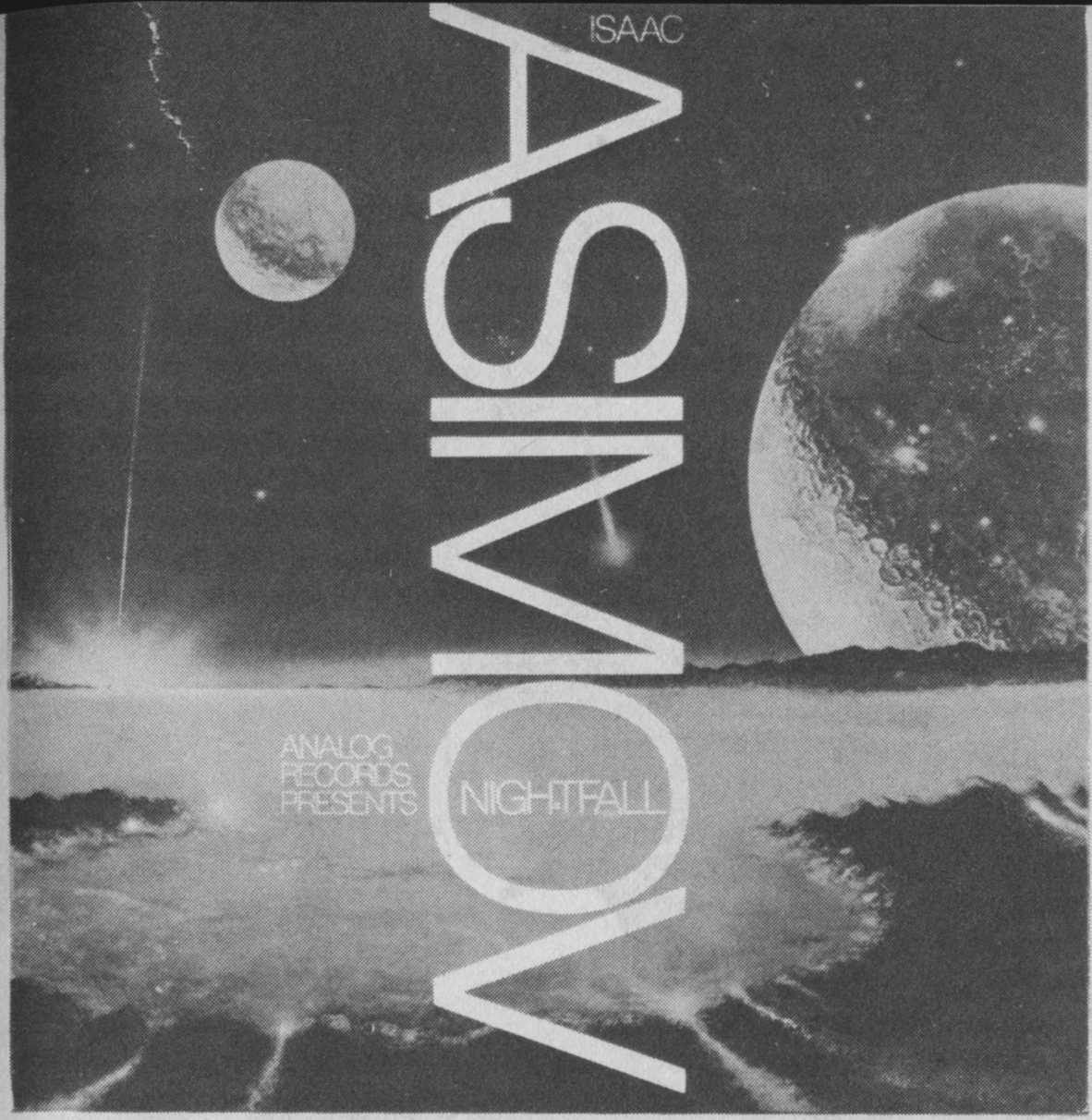
Quite frankly, we were astounded when we duplicated the techniques described in your paper. We would be interested in seeing a second paper which elaborates, mathematically, on the specific chemical and physical processes of your demonstration, as we believe the present one will attract considerable attention.

We wish you well in your new post at the South Australian Boy's Military Prep School, and the galley proofs of the paper will be sent to you there.

Cordially,

Peterson S. Day

Peterson S. Day
Editor, *Review of High School Experimental Science*



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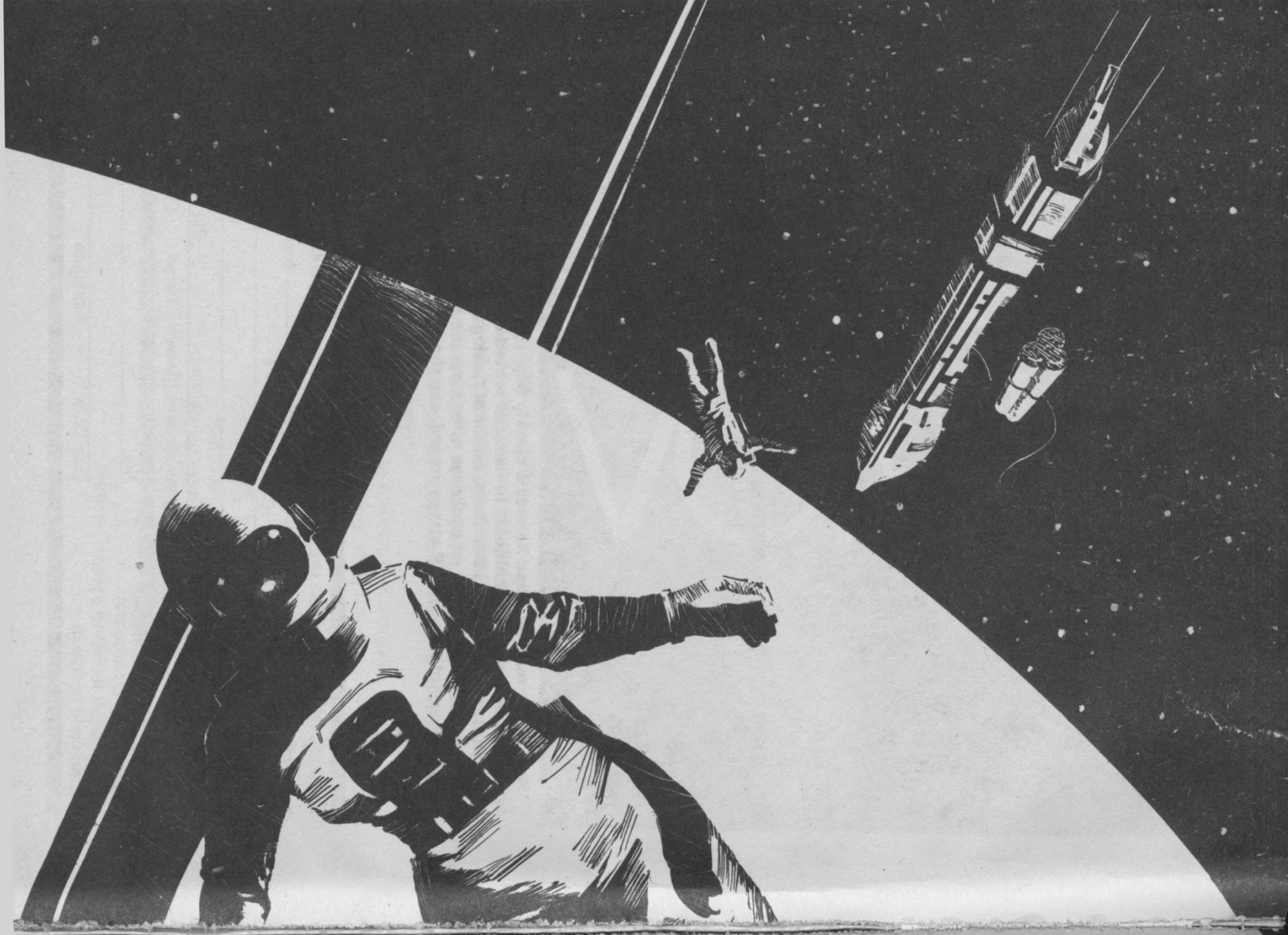
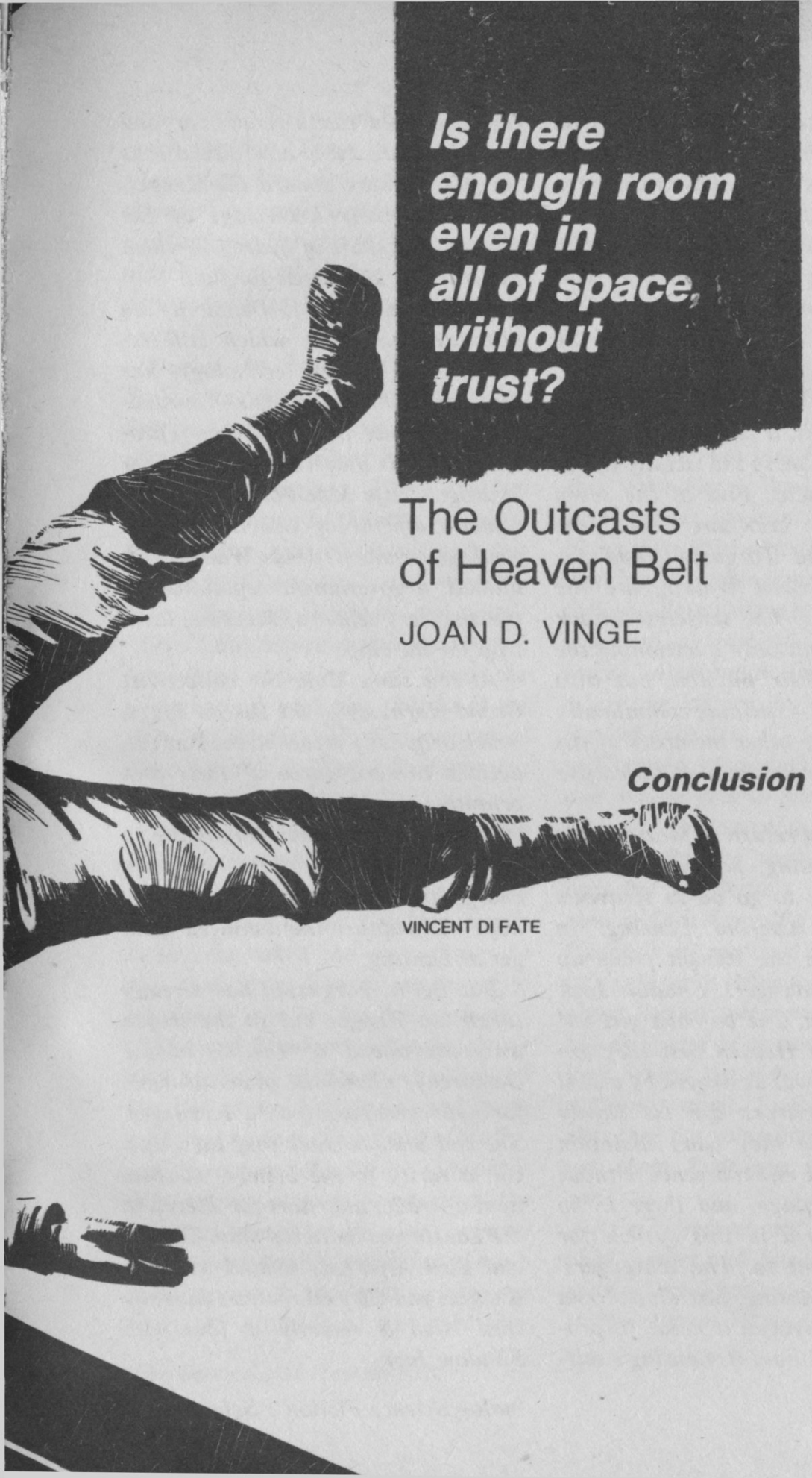




Is there enough room even in all of space, without trust?

The Outcasts of Heaven Belt

JOAN D. VINGE

Conclusion

VINCENT DI FATE

Morningside is a human colony on the bleak innermost planet of a red dwarf sun. Its colonists, hoping to establish trade contacts to improve their life, have sent the ramscoop starship Ranger *to the Heaven system, where an asteroid belt civilization exists that is supposedly the most successful in human history.*

But when the starship reaches the Heaven system, it is attacked, for no apparent reason, in the vicinity of the gas giant Discus. Five of the seven people in the crew are killed; the captain, Betha Torgussen, and the navigator, Clewell Welkin, are the only survivors. The senseless attack leaves them not only questioning the purpose of their mission, but also their ability to continue; communally married to the other members of the crew, they are suddenly widowed five times over.

They cannot return to Morningside without refueling, however, and so Betha decides to go on to Heaven's capital, the asteroid Lansing. In Lansing space the Ranger *picks up two young scavengers, Shadow Jack and Bird Alyn. The boy and girl tell them that the Heaven Belt they expected to find was destroyed by a civil war. The survivors are all slowly dying, because they can't maintain their artificial environments without a high technology, and there is no Earthlike world in this system for them to retreat to. The scavengers' own world, Lansing, has almost run out of the hydrogen it needs to produce water; without it, Lansing's self-contained Old Earth ecosystem, and its people, are dying now. Betha asks the pair to stay aboard the* Ranger, *and trade their knowledge of the system for a share of hydrogen, which the starship also needs for fuel.*

In the meantime, the Demarchy, an absolute democracy which still retains a fairly high technology, has discovered the starship's "miraculous" presence in the system. Theorizing that it may come to them for hydrogen, Lije MacWong, an opportunistic official of the Demarchy's weak government, sends Wadie Abdhiamal, a government negotiator, to the distillery center of Mecca to lay a trap for the ship.

At the same time the collectivist Grand Harmony of the Discan Rings, which originally attacked the Ranger, *decides to send three of their own primitive chemical-powered ships after the starship. Raul Nakamore, a high-ranking naval officer, is put in charge of the mission, which they hope will capture the damaged* Ranger *at Lansing.*

But Betha Torgussen has already taken the Ranger *out to the trojan asteroids ahead of Discus, to the Demarchy, where she plans to trade for hydrogen posing as a Lansinger. She and Shadow Jack take the ship's cat, a rarity to the belters, as their item of trade, and start for Mecca in the Lansingers' battered ship. Clewell and Bird Alyn stay behind with the* Ranger; *and Clewell realizes that shy Bird Alyn is secretly in love with Shadow Jack.*

After two grueling weeks in the Lansing 04, *Betha and Shadow Jack reach Mecca. They are harrassed when they land by Demarchy mediamen—a cross between reporters and admen, the product of the Demarchy's fiercely competitive corporations and its communications network.*

During the shuttle ride to Mecca's dark side, Betha thinks about her first husband, Eric, an ombudsman who could have helped her in dealing with these strangers. There are two other passengers in the car, who press unwanted conversation on the two "Main Belt survivors", and when the man clears his faceplate she sees—"Eric!" But before she clears her own faceplate, exposing her face, she stops herself, realizing that he is not Eric . . . Eric is dead. *The man introduces himself as Wadie Abdhiamal, a government negotiator.*

After they enter the geode-form subterranean city of Mecca she begins to wonder why Abdhiamal seems to be following them. Growing suspicious, she takes the opportunity to slip away from him into a crowd of mediamen who are badgering them.

She and Shadow Jack take an air taxi to the corporate tower of one of the Demarchy distilleries, and begin to negotiate there for a load of hydrogen. Esrom and Sia Tiriki, the corporate representatives—and also the son and daughter of the company owner—are doubly awed that the two have apparently made the journey out from the Main Belt, and that they actually have a live animal to trade.

Just when it appears that the deal will go through, Esrom Tiriki discovers Betha's face on a news printout, and realizes the real significance of their visit. The Demarchy's sophisticated prewar communications network is intact, and Betha sees, too late, that virtually everyone in the Demarchy must have been watching for her. As Shadow Jack starts for the door, he runs into Wadie Abdhiamal, who has followed them here; Abdhiamal confronts the Tirikis about their monopolistic plans for the starship. In the tense debate that follows, Betha manages to play both sides off against one another, and forces Abdhiamal into a position where he agrees to return to the Ranger *with her.*

They rendezvous with the starship, and Wadie gets to see firsthand the incredible resource the Ranger *represents. But he took a gamble in agreeing to Betha's demands, and now he finds himself a hostage of the* Ranger*'s mismatched crew. The captain refuses to listen to his arguments about Heaven's desperate need for the starship, and he senses a deep bitterness behind her refusal that he does not understand. She tells the crew that they are going back to Discus, to get their hydrogen any way they can.*

After sleeping, and exploring the ship—under the burden of its one-gravity acceleration—Wadie returns to the control room again. He finds

the crew watching media broadcasts from the Demarchy, just as a General Meeting is called on the screen. A "town meeting" debate about the incident at Mecca follows: Esrom Tiriki accuses Lije MacWong and himself of acting against the interests of the people, and allowing the starship to escape. Unable to participate or to explain his own actions, Wadie watches in disbelief as MacWong calmly denounces Wadie Abdhiamal as a traitor to save his own job, and the people of the Demarchy agree with him. Their electronic vote is virtually instantaneous—and it sentences Wadie to death, if he ever returns to the Demarchy.

Later, Wadie searches out Betha to tell her that he has decided she is right not to trust any group in Heaven, even the Demarchy: that their need for the starship is so great their own greed will destroy them all. The starship will be their end, not their salvation, and so he has decided to do everything he can to help the Ranger *escape: "If I've got to be a traitor, I'll be a good one." He offers her the specialized knowledge about the Ringers' vital main distillery that he gained while working as a negotiator when the Demarchy helped them build it. Betha accepts his offer gratefully.*

Abdhiamal goes with her when she leaves the control room to look for Clewell. In front of Clewell, in the shop, he inadvertently insults her and at the same time reminds her again, painfully, of her dead husband Eric. Turning on him, she calls him a useless fop, living at the expense of his people; both Wadie and Clewell are left wondering what caused the outburst.

After she leaves them, Betha sees Shadow Jack rebuff Bird Alyn's timid advances and send her away in tears. Already angry, she confronts him about his behavior; only to have him, in apparent hatred, call her a "pervert" for being a part of a communal marriage.

Stunned, she goes after him to the hydroponics lab, where he has found Bird Alyn. She listens, unseen, as he tells Bird Alyn that he has always loved her; but that they can never be lovers, because they are genetically defective, and he can't face the pain of their giving birth to a horribly deformed child. Understanding their real problem at last, and unable to do anything about it, Betha silently leaves them alone.

The Ranger *reaches Discus again, and locates Snows-of-Salvation, the crucial distillery that Wadie helped to build. With a calmness that is no reflection of his real emotions, he gives Betha the information she needs to intimidate Djem Nakamore, Raul's half-brother, who is in charge of the distillery—and who was once Wadie's friend. In betraying the Grand Harmony, he gives up his chance of finding a haven there in his exile.*

Betha tells Nakamore that she will destroy the distillery unless he gives them the hydrogen, with such cold

conviction that Wadie and the others suddenly doubt that she is bluffing any more. Uneasily, they begin their wait for Nakamore's reply.

Betha watched him disappear down the stairwell, shaken with the coldness that left her words of apology stillborn.

"Betha . . . would you . . . are you really goin' to . . . destroy the distillery?" Bird Alyn whispered unhappily.

Betha met the frightened face. "No, of course not, Bird Alyn. I wouldn't do that. I'm not really a—a butcher."

Bird Alyn nodded, blinking, maneuvered backwards and started for the door.

Clewell rubbed his beard. "Then why act like one, Betha? That was a little too convincing for me, too. Or isn't it an act, anymore?"

Shame warmed her face, drove the coldness from her. "You know it is, Pappy! But that damned Abdhiamal—"

Clewell lifted his head slightly, unfastened his seat belt. "He's not such a bad sort . . . for a 'damned fop'. He's held up pretty well under one gee . . . under everything he's been through." Meaning that she hadn't made things any easier.

"He's a phony; he's lucky he didn't cripple himself." She looked away irritably.

"He's a proud man, Betha . . . he might not call it that. . . . But anybody who can stand straight and smile while gravity's pulling him apart—or loyalty is—has my admiration. In a way, he reminds me of—"

"He's not at all like Eric."

His eyebrows rose. "That wasn't what I was going to say. He reminds me of you." He held up a hand, cutting off her indignation. "But, now that you mention it, there is something about him . . . a manner, maybe; even a physical resemblance. Maybe it's why I like him in spite of myself; maybe it's what bothers you. Something does."

"Oh, Pappy . . ." She lifted her hand, pressing her rings against her mouth. "It is true. Every time I look at him, anything he does, he reminds me— But he's *not* Eric, he's not one of us, he's one of *them.* How can I feel this way? . . . How can I stop wanting . . . wanting . . ." She reached out; Clewell's firm, weathered hand closed over her wrist.

He smoothed her drifting hair. "I don't know. I don't know the answer, Betha." He sighed. "I don't know why they claim age is wisdom. . . . Age is just getting old."

Shadow Jack moved restlessly, trapped in the too-empty box of the room where he slept, haunted by the ghost of a stranger: manuals on economics, a nonsense song lyric, a hand-knit sweater suspended in midair—a dead man's presence scattered through drawers and cupboards in the clutter of a life's detritus. Rusty clung to his shoulders, her mute acceptance easing the shame of his exile. He mindlessly stroked her, hearing only

the ticking of the clock; meaningless divisions marking the endless seconds. He wondered whether they would get what they wanted from the Ringers, wondered how he could face Betha Torgussen again . . . wondered how he would face the rest of his life.

Rusty's small, inhuman face rose from his shoulder, her ears flicking. "Bird Alyn?" He pushed to the doorway, saw Wadie Abdhiamal disappear into another room. He heard Abdhiamal's voice, almost inaudible: "Damn that woman! She'd spit in the eye of God—"

Shadow Jack moved along the hall, stopped at Abdhiamal's doorway, staring. "What's the matter, she spit in your eye?"

Abdhiamal twisted, a split-second's exaspiration on his face. He smoothed his work shirt absently, smoothed his expression. "Yeah . . . somethin' like that."

"What happened up there; did we get the hydrogen?"

"Probably. . . . Why weren't you in the control room?"

He grimaced. "I couldn't do it. I—I called the captain a pervert."

"You what?" Abdhiamal frowned in disbelief.

Shadow Jack caught the doorway to move on, desperation turned him back. "Can . . . I talk to you . . . man to man?"

Abdhiamal gestured him into the room, no trace of amusement on his face. "Probably. What about?"

Shadow Jack cleared his throat; Rusty pushed off from his shoulder, rose like a lifting ship and swam toward Abdhiamal. "How come you never married?"

Abdhiamal laughed, this time, startled. "I don't know . . ." He watched the cat, reached out to pull her down to his chest. "Maybe because I never met a woman who'd spit in the eye of God."

Shadow Jack's eyes widened; and looking at Abdhiamal, he wondered who was more surprised.

Abdhiamal laughed again, shrugged. "But somehow I doubt it."

"I mean . . . you said before, that now you never would get married. I thought there was—some other reason." He reached for the doorframe.

"There was."

He stopped, holding on.

"I traveled a lot, that means I've been exposed to high radiation levels, and potential genetic damage. We have ways of preservin' sperm, so men at least can travel, and still raise healthy children. But with the bill of attainder, I'm legally dead now. They'll destroy my account." Abdhiamal took a deep breath. "And I've been sterilized."

Shadow Jack looked back, letting the words come, "I'd be happy if I was sterile!" He shook his head. "I didn't mean . . . I didn't mean it like that. But we can't ever get married, Bird Alyn and me; because I'm not sterile, and she's not. We *are* defective, we shouldn't ever have children; but we would—"

Abdhiamal scratched Rusty under the chin. "It's a simple operation.

Can't they perform it, on Lansing?"

"They could . . . but they won't." Misery hung on him like a weight. "If you're a Materialist, you're supposed to take responsibility for your own actions, you're supposed to take the consequences, not expect anybody else to do it for you. Like my mother, when my sister was born an' they said she was too defective . . . my mother had to put her Out. . . . She wouldn't let my father touch her anymore . . ." He looked down, at his hands. "But, the medical technology's bad anyhow, sometimes I think they just don't want to waste what's left."

Abdhiamal's voice was gently professional. "How were you judged defective? You look sound to me."

Shadow Jack's hands tightened on metal. "Maybe I wasn't defective, then. But my sister was. And they needed more outside workers, so they told me I had to work on the surface. That's what you do if you're a marginally-damaged, like Bird Alyn. That's where I met her. . . ." Where he had discovered what life must have been like once, lived in the beauty of gardens and not the bleakness of stone. And where he had discovered that his own life did not end because he had left the shielding walls of rock; that feeling did not, or belief, or hope. But he had spent too many megaseconds mending a tattered world-shroud, too many megaseconds in a contaminated ship. . . . And there were no miracles to heal a crippled hand, or mend a broken heart.

He struck the doorframe. "Everything goes wrong! I didn't mean to call Betha—what I called her. But she had so many husbands, she even has children! When Bird Alyn and me can't even have each other . . . it just made me crazy. Betha lost so much, and I said—I said that to her. She helped us, after we tried to take her ship just like everybody else—"

"You did? And she let you get away with it?"

He nodded, feeling ridiculous. "All we had was a can opener . . . I guess she thought we were fools."

"And—you said she has children?" Abdhiamal looked down at the wide leather band circling his wrist.

"Yeah. Goin' into space is like . . . like doing anything else, to them. It's not the end of anything." He bit his tongue, remembering that it had been, for the crew of the *Ranger*.

"If she forgave you for trying to steal her ship, I expect she'll forgive you for callin' her a pervert. Sooner than she'll forgive me, for makin' remarks about engineers."

Shadow Jack frowned, not understanding.

Abdhiamal's smile faded. "It seems you and I have more than one problem in common. Like every group in Heaven Belt shares the problems of every other one. And . . . I'm not so sure anymore that there's an easy answer for any of us."

Shadow Jack turned away; saw Bird Alyn, watching him from the end of the hall. He met her eyes, hopelessness dragged him down like the chains of gravity. "There aren't any answers

at all. I should have known that. Sorry to take up your time, Abdhiamal."

Wadie closed the door, still cradling the cat absently against his side. In his mind he saw the future on Lansing, grief and death among the gardens—and saw in Lansing the future of all Heaven. . . . *The future?* Silence pressed his ears, deafening him. *The end.* The Demarchy was only one more fading patch of snow. There was no answer. Nothing he could ever do—nothing he had ever done—would hold back Death. He had made himself believe that his work had some relevance and worth, that a kind of creation existed in his negotiations, a binding force to keep equilibrium with disintegration and decay. But he had been wrong. It had always been too late. He was a damned fop, living at the expense of everyone else . . . and wasting his life on the self-delusion that he was somehow saving them all. Wasting his life: he had thrown away his last chance of ever having a life of his own, a home, a family, any real relationship. And all that he had ever done, or been, or believed was meaningless. It had all been for nothing—and it would all be nothing, in the end. *Nothing.* Rusty squirmed in his grasp like an impatient child. As he released her his arm scraped the ventilator screen; his hand closed over a flat, palm-sized square trapped by the soft exit of air. He pulled it down, stared at it. A picture—a hologram—of a man and a woman, each holding a child, flooded in blazing light where they stood before an ugly, half sunken dwelling. The woman was Betha Torgussen, her hair long, coiled on her head in braids. And the man, tall, with dark hair and a lean, sunburned face. . . . *Eric?* Her voice came to him suddenly, from behind a shielding faceplate, in a train car on Mecca. *I—I thought you were someone I knew.* Wadie brushed the images with a finger, moving through them. Ghosts. . . .

Betha Torgussen's voice came to him out of a speaker on the wall, telling the crew that Nakamore had acquiesced.

***Ranger* (Discan Space)**

+2.74 Megaseconds

"Okay, Pappy, the cables are secured. We really outdid ourselves when we closed with this load! Start us in." Betha raised her chin from the speaker button, hooking her arm under the twisted strength of the steel cable, secure in the crevice between cylinders of hydrogen. She felt the abrupt lurch as the winches started the final shipment of fuel moving in toward the looming brilliance of the *Ranger.*

"This is the lot, Betha," Clewell's voice filled her helmet, smiling. She imagined his smile, felt it, through the ship's mirrored hull.

"This is it. We've done it, Pappy! We're really going to make it—" Through the shielded faceplate of her helmet she saw the molten silver, the ruby scarab of Discus reflecting on the *Ranger*'s hull, rising above a dull-

green horizon of clustered tanks, marred by a tiny spot of blackness. The shadow of Snows-of-Salvation . . . or a ragged hole torn in the metal. She looked away, dizzy, past the small bright-suited figure of Shadow Jack at one end of the fifty-meter-long bundled cylinders. And out, into the void; imagined the merciless drag of the Discan gravity well pulling her loose into the endless night . . . like five others before her. She shut her eyes, clung to the cable; opened them again to look down at the solid surface of the tanks, along the dull greenness at Abdhiamal, inept and uncommunicative at the shipment's other limit. They were almost flush now with the *Ranger*'s massive protection; it would be over soon. *One more, just one more time.* . . . Sweat tickled her face, she shook her head angrily inside her helmet. *Damn it! You won't fall—*

"Betha!" Bird Alyn's voice, rising clearly for once above the crackle of her feeble helmet speaker. Bertha saw her, gnatlike beside the immense holding rack clamped to the ship's skin. "The load's not closing even! . . . Abdhiamal, your end—the end cable's caught between tanks—"

"I'll clear it."

"Abdhiamal, wait!" Betha saw him go over the end, the flash of his guidance rocket as he disappeared. "Pappy! Loosen the aft cable, right now!" She pulled her own guidance unit loose from the catch at her waist, pressed the trigger, sent herself after him to the end of the world. Looking over, she saw him hovering near the hub of the wheel of tanks, the cable trapped between two cylinders. She saw him catch hold of the cable, bracing his feet, and pull—"Abdhiamal, stop, stop!"—saw the cable slip free . . . watched as the bound tanks recoiled below her and the cable wrenched loose from the hull, arcing soundlessly toward her like a striking snake. She backed desperately, knowing, knowing—

"Clewell—!" Her face cracked against the helmet glass in starbursts of light as the cable struck her across the chest, throwing her out and away from the ship. She fought for breath, blood in her mouth, her lungs crippled with pain, saw the ship like a fiery pinwheel slip out of her view, blackness, blood and molten silver, blackness. . . . She fumbled for the trigger of her guidance rocket, but her hands were empty. And she was falling.

No— Betha began to scream.

Wadie felt the cable slip loose as the captain's voice reached him, telling him to stop. He fell back, suddenly unsupported, looking up in surprise—to see what he had done, see the tanks rebound, the cable lash out like a whip and knock her away . . . saw her guidance rocket fly free, tumbling, a spark of light. "Oh my God—" He heard the cries of Bird Alyn and Shadow Jack, echoing his own, no sound from Betha Torgussen; waved the others back as he went after her into the night.

The immensity of isolation stifled

him, filling the black-and-brilliant desolation like sand, dragging at him, holding him back . . . as the isolation of his own making had cut him off from truth all his life. He closed with her spiraling form slowly, agonizingly, centimeters every second . . . seeing in his mind a ruptured suit, a frozen corpse, her pale, staring face cursing him even in death for the hypocrisy of his wasted years. Yet wanting, more than he had ever wanted anything in his life, to close that gap between them, and see instead that it was not too late. . . .

And after a space as long as his life his gloved hand clamped over an ankle, he drew her toward him, and used his guidance unit to stop their outward fall. He caught her helmet in his hands, felt her clutch him feebly as he searched behind the silent, red-fogged glass for a glimpse of her face. Repeating, wild with relief, "Betha . . . Betha . . . Betha, are you all right? Answer, please."

Her shadowed face fell forward, peering out; her chin pressed the speaker button. "Eric . . . oh, Eric." He heard her sob. "Don't let me go . . . I'll fall . . . don't let go, don't let go . . ." Her arms tightened convulsively, silence formed between them again. He stroked the tempered glass, "I won't . . . it's all right . . . I won't let you go—" The plane of the Discan rings blinded him with frigid glory, as immutable as death; he turned away from it, started them back toward the diminished ship, across the black sand desert of the night. She kept radio silence; he did not search for her face again behind the blood-reddened glass, granting her the privacy of her grief, feeling the ghosts of five human beings move with them. And at last he heard her voice say his own name, thanking him, and say it again. . . .

"What happened?"

"Is she all right?"

"Betha, are you all right?"

The voices of Shadow Jack and Bird Alyn clamored in his helmet as they met him, their hidden faces turned toward Betha, gloved hands reaching out.

"She's hurt. Help me get her inside." She scarcely moved against his hold, silent as they made their way through the airlock.

They entered the control room, her hands still locked rigidly on his suit. He looked across the room at the panel, looking for Welkin; cleared his faceplate, suddenly aware that nothing moved. "Welkin?" He saw a hand, motionless above the chair arm, and his throat closed.

Betha raised her head as if she were listening, but he could not answer. She released her grip, pushing away from him. "Pappy?" Her voice quavered, she folded into a tight crescent in the air, her arms wrapped against her stomach. "Pappy . . . are you there?" He heard a small gasp as she tried to lift her hands. "Somebody . . . get this helmet off. I can't see. Pappy?"

"Betha—" Shadow Jack began, broke off.

Bird Alyn moved to release Betha's helmet, lifted it slowly, jerked back at

the sight of her face filmed with blood.

But Betha had already turned away, shaking her head to clear her confusion, pulling distractedly at her gloves. She froze, as she saw the old man's drifting hand. "Oh, Jesus." Her own hand flew out, caught at Bird Alyn's suit, groping for purchase. Bird Alyn put an arm around her, helped her cross the room; Wadie followed.

"Pappy . . ." Her voice broke apart as she reached him.

Welkin opened his eyes as she touched his face, stared her into focus uncomprehendingly, his right hand pressing his chest. She laughed, or sobbed, squeezing his shoulder. "Thank God! Thank God . . . I thought . . . you're so cold . . ."

"Betha. Are you—?"

"I'm all right. I'm fine." She put a trembling hand up to her face, glanced at her bloody fingertips. "Just a . . . nosebleed. What—what happened—?"

"Pain . . . in my chest, like being crushed; down my arm. . . . Must be my heart. Was afraid to move. When I saw . . . what happened to you, on the screen—"

"Don't. Don't think about it . . . it's over. We'll make it, Pappy. We'll make it yet. Close your eyes, don't move, don't worry, just rest. We'll take care of you." She managed a smile, new blood blurring on her chin, her hand gently cupping his face.

"Should we get him to the infirmary?" Wadie hesitated near her shoulder, forcing himself to speak.

"No." Welkin shook his head, eyes shut. "Not yet. . . . Finish the job!"

"He's right. We shouldn't move him yet, anyway. Thank God we're in zero gee . . ." Betha pulled a scarf out of a cubby under the panel, starting a small blizzard of papers drifting. She wiped her face and spat gingerly, wincing. Wadie saw her control slip again, saw pain show, and her body bend as she pushed out of Welkin's sight. Bird Alyn moved back to her side, mouth open; she frowned, straightening, shook her head. "All right. Pappy said it, we're going to finish the job. Nothing . . . will stop us now! I'll start the winch. Bird Alyn, get back outside . . . and make sure the load is secured. Shadow Jack, you'll chart us a course for Lansing. Tell me what you need to know; I'll double-check you. . . . Abdhiamal—"

He met her eyes, bracing against what he expected to see, "Keep the hell out of your way?"

Expressionless, she said, "Go to the infirmary and get me a hypo of painkiller for Clewell. They're prefilled, with the first-aid supplies." She caught hold of a chair back, shook her head. "Make it two hypos . . . And then," her eyes changed, clung to him, "keep the hell out of my way, Abdhiamal!"

***Grusinka-Maru* (In Transit, Demarchy to Discus) +2.75 Megaseconds**

". . . how you intend to explain what your man's done now, MacWong? He must've shown the outsid-

ers how to get that hydrogen. He's made certain we can't catch the starship before it leaves the system now." Esrom Tiriki moved incautiously in the overcrowded space of the ship's control room.

"He isn't 'my man' anymore, Demarch Tiriki. He was declared a traitor," Lije MacWong repeated wearily. *Is a traitor, much to my surprise. Why? Revenge? A reasonable assumption.* . . . "In any case, he didn't deliver the starship to the Ringers, either."

"But you said he would."

"It was a reasonable assumption." MacWong felt unaccustomed tension tightening the muscles in his neck—brought on by the discomfort of the ship's acceleration, and by the effect discomfort was having on everyone else, as well. He silently regretted the ill fortune that had made Tiriki Distillates a part-owner of this fusion ship, and permitted Esrom Tiriki to be here as its representative. Tiriki—and his company—had suffered considerable embarrassment when their personal plans for the starship had been exposed; even Tiriki's two fellow representatives had begun to let their disapproval show as their tempers shortened. MacWong further regretted that Tiriki did not have the self-control to suffer in silence.

The Nchibe representative drew Tiriki's unwelcome attention again and MacWong drifted away, past a yawning, fawning mediaman in Nchibe livery. They had picked up the Ringers' reply to the starship's threats, and it had been sent on to the Demarchy—as all crucial information was, and would be, during their pursuit. The people, the changeable god to whom he had offered up Wadie Abdhiamal and other sacrificial scapegoats, kept watch over him even here. But now for once the people kept their silence, because any response would have reached the starship too, and revealed their pursuit. For possibly the only time in his career he had a measure of freedom in his decision-making; he was not sure yet how much he could afford to enjoy it.

Because the next decision he would make now—and answer for later—was whether to continue pursuing the starship, or to return to the Demarchy. And the decision was not as obvious as it seemed. . . . The starship had taken 1000 tons of hydrogen—far more than it needed to escape from the system, from what Osuna had told him. Enough fuel to critically cripple its speed and maneuverability. Had they done that for revenge, too? Somehow he doubted it. They had destroyed a ship before; this time they could have destroyed so much more . . . they could have destroyed the major distillery— But they hadn't. He experienced a curious mingling of fascination and relief.

But the starship had gone to Lansing when it first entered the system; there had been a Lansinger with the woman at Mecca. If its crew had made some sort of deal with Lansing, that could explain a lot of things. And it would mean that the starship would

not be heading directly out of the system: that there was still a chance for these ships to overtake it.

MacWong looked back as the ship's pilot approached Tiriki and the others, to interrupt them deferentially. And what would happen, if they captured the starship? He glanced out of the port beside him, seeing the long, intensely lavender thread of a second ship's torch reaching across the night. By then they would be millions of kilometers from the Demarchy—these three armed ships, and the men who controlled them: Ambitious men, men who enjoyed power, men like Esrom Tiriki. No matter what the people decided concerning the starship, by then there would be no way that the Demarchy could force these men to obey it . . . and no one would be quicker to realize that. His nearness to Tiriki and his insulation from the people had made him understand what Abdhiamal had known instinctively from the start: That the starship which could be their salvation could instead turn out to be the bait for a deadly trap.

He sighed. *You were always a better man than I was, Wadie; and that was your whole problem.* . . . And maybe that explained Abdhiamal's treason better than any speculation about revenge. He had been more than sorry to make Abdhiamal into a man without a world . . . but maybe in the end it would turn out to be the best move he had ever made. And perhaps now he had the opportunity to repay Abdhiamal in part, as the spokesman of the people—by keeping his mouth shut about what he knew.

"Demarchs—" The three company men and the pilot looked up at him together; he watched a mediaman adjust a camera lens. "I think we all know by now that our attempt to seize the starship has failed. But at least it hasn't fallen into enemy hands. It's leavin' the system; we might as well save a further waste of our own resources, and return home—"

"Maybe we haven't lost it yet, Demarch MacWong," Tiriki showed him a porcelain smile that was somehow more unpleasant than his former petulance.

"We've just been given some new information about the starship." The Estevez nephew nodded at the ship's pilot. "Lin-piao says that the ship isn't leavin' the system; it's turned back in toward the Main Belt.

"To Lansing," Tiriki said. "They're goin' back to Lansing."

"We still have a chance to take it; Lin-piao says it's only doing one-quarter gee now."

MacWong hesitated, seeing the three of them united, finally, in the purpose of carrying through their mission. And behind them the entire Demarchy watched in silent judgment. It knew what they knew; and it knew that he, MacWong, had instigated this pursuit. The people didn't know everything—but had they already learned too much? He could still press for a retreat . . . but would they accept it, now? "If the people feel that a further effort to pursue the star-

ship wouldn't be worth the Demarchy's while, I hope they'll let us know." He spoke the words to the waiting cameras with careful emphasis. "In the meantime—" he felt the intentness of seven sets of eyes, feeling the pressure of a thousand more behind them, "—in view of this new information, I feel we should continue our mission. I have personal data, concernin' the starship's entry into the system and its fuel needs, that support the theory it's headin' for Lansing now." *Sorry, Wadie,* he watched the faces relax into satisfaction and complacency, *but it's my job to give the people what they want.* He matched them smile for smile, one satisfaction for another.

"Demarchs . . ." the pilot pulled self-consciously at the hem of his golden company jacket. "By the time we've changed course, we still may not be able to catch up with 'em. Even if the starship can only manage one-quarter gee, by the time we decelerate again for Lansing ourselves—"

The pilot broke off, as a frown spread among them like a disease. MacWong weighed its significance like a physician; and prescribed the remedy that he knew would heal any damage to his own credibility: "I think that may not turn out to be a problem, demarchs. If you'll consider the follow in' course of action—"

***Ranger* (In Transit Discus to Lansing) +2.96 Megaseconds**

Wadie walked the corridor to Betha Torgussen's private room, slowed by one-quarter gravity and the fatigue of their work in space. And by the same tangle of emotion that drove him to face her now. . . . The memory of the Discan sky, hazed with shining flotsam and hung with crescent moons, haunted him: the knowledge of a costly victory won and almost lost again by his own actions; two lives, the last of the Morningside crew, almost lost—and with them the part of himself that he had only just begun to discover. . . .

He reached the open door, stopped as the hallway slipped back into focus, and stepped through.

Rusty's head appeared suddenly from a cocoon of bedding, watched him like a familiar as he looked across the room. The captain sat at her desk, her back to him, her attention lost among scattered displays and printouts. Empty coffee cups littered the desk top; there was a sign above her head on the wall, TEN YEARS AGO I COULDN'T EVEN SPELL "ENGINEER", AND NOW I ARE ONE. He smiled briefly, until he heard her sigh, a sound that was a small groan. The vision formed inside his eyes of her cracked and bandaged ribs, a bruise the width of his arm.

He turned abruptly to leave the room again, found a picture on the wall inside a broad green arrow pointing DOWN: found Betha Torgussen, and Welkin, and—Eric, bearded now and smiling. With them, two more women, two more men, and seven children bundled in heavy clothes; all pale, laughing, waving in three dimensions,

joyfully disheveled against a background of snow. A family who knew how to share . . . and somehow, with the fever of futile greed that burned through Heaven, their sharing no longer seemed so alien, or so bizarre—

Rusty stirred on the bed, blinking; she *mrr*ed inquiringly. Betha turned across the back of her chair, controlling a grimace, her own eyes suddenly quick and nervous, questioning his presence.

"Betha . . . I'd like to see you, if you don't mind. There're some things I think I need to say." He crossed the room.

"All right, Abdhiamal . . ." Her eyes went to his wrist, Clewell's wristband. "Yes, maybe you should." Her face changed, "But first, tell me how Clewell is. How is he taking the acceleration?"

"Well enough, I guess. He's very weak, but he's no fool . . ." *And nobody's fool*— Sudden appreciation for the old man filled him. "I don't suppose I'd have the guts to be here if I didn't believe he was goin' to be all right. . . . But what about you? What are you tryin' to prove, why the hell aren't you getting some rest—" not sure who he was really angry at.

Her bruised mouth tightened. "Because I'd rather be sore than dead. And yes, I am trying to prove something," she gestured at the computer terminal, her expression easing. "I—didn't know whether to let you know about this, but . . . We've detected a patch of hydrogen and helium, doppler-shifted into the red; I think it's a hydrogen fusion torch pointed away from us. Right now it's still thirty million kilometers behind us—but we're being followed."

"You can detect an averted torch at that range? Your instruments are better than ours." He was impressed, again.

"Are they? Good. . . . But with these fuel cannisters strapped to the hull, we can't move faster than whoever's behind us. What I need to know is whether the ships come from the Demarchy, or Discus; and, if they are from the Demarchy, what you think their mission is. Do they still want to take the ship, or are they out to destroy us?"

He leaned on the desk, the tendons ridging slightly in his arm. "Good question. . . . The ships are from the Demarchy. Nobody else has anythin' like that left; the Ringers have only oxyhydrogen rockets. Our—the Demarchy's—fusion ships are owned by interests in the most powerful tradin' companies, but in times of 'national emergency' the Demarchy commandeers 'em. Which means MacWong's story about my handing you to the Ringers must've been well-received. . . ." He stopped. "He knows it was a damn lie; and knowin' him, I'd say that means he did it because he still wants this ship, and that was the only way he could think of to get the ships to follow you."

"But then he must know that we'll still outrun them, now that we've got the fuel; even if we stop at Lansing. If they have to do a turn-around to

match our deceleration we'll be long gone before they reach us. If they don't slow down, they'll overshoot . . . and all they could do then would be destroy us in passing." Her fingers tapped nervously.

He nodded. "He'd know that too. But he wants that ship intact for the Demarchy, and he's not the kind to mine quartz and think it's ice. He's got somethin' planned; but I don't know what."

"At least we know where they are, and they don't know we know. If they were counting on surprise to close the gap they've lost it." She shifted in her seat, leaning hard on the desk top. "I suppose we'll know more when we begin decelerating, and see if they do the same. Even if they don't slow down. . . . Well, depending on what you can tell me about the range of their weapons, I think we can still make a stop at Lansing long enough to off-load the extra hydrogen—and then accelerate at right angles to them with enough time to get away. By the time they can change course, we'll be out of this system forever."

"Out of our system forever. And we'll be . . ." He looked down at her strong and gentle face, wondered why he had ever thought it was plain. His hands tightened over a sudden desire to touch it.

Realization colored her cheeks. She looked up at him strangely, almost welcoming, lifted a hand. "Sit down, Abdhiamal . . . Wadie Abdhiamal. You'll be—better off without us, yes."

He sank down on the padded wall seat, pushing aside heaped clothes. "Betha. There're no words to apologize for what we've done to you. And when it comes to things I've done to you, out of my own stupidity . . . my God, I nearly—killed you . . . all the things I said, not meanin'—"

Her hand waved the words to silence. "I never meant to ruin your life, Wadie. . . . I owe you as many apologies as you owe to me. More. Is it too late to cancel them all out, now?"

He leaned back, resting his head against the wall, eyes on her. "It's never too late. But I'm not—very good at expressing my emotions, Betha. I'm not even good at admitting them to myself." He took a long breath. "All of a sudden there are a lot of things I want to be different. But there's so little time—" He broke off; feeling the presence of ghosts. "That picture across the room: Is that—Eric, beside you?"

Surprise caught her. She nodded, her face composed. "He was my first husband. He was—a kind of negotiator too, an ombudsman. We were monogamous for eight years before we married into Clewell's family."

"And you have children?"

"The twins, Richard and Kirsten; the boy and girl in front of me, they're about eleven now . . ." She smiled. "They're all my children. But the twins were born to me, they have my name. All seven of our kids who are still at home are staying with my family."

"You left your children—" He

stopped himself before he hurt her again. *We do change; but change always comes too fast . . . and too late.* And there were only one hundred kiloseconds remaining until they reached Lansing.

She glanced at him, puzzled. "Yes. We left them with my parents, on their tree farm . . ." And understanding, "Half the world is your family when you're growing up on Morningside. They hug you, and tell you stories, and make you toys . . . there's always someone who's glad to see you. We didn't abandon our children. But it has been very hard, to miss seeing so much of their lives, as they grow. At least Clewell and I will still get to see how they've grown. . . ." She looked down, shuffling papers; he saw the return of more than one kind of pain.

"Shadow Jack and Bird Alyn . . . are they why you're risking everything, to buy a dyin' world a few more seconds?"

She hesitated. "I don't know. I hadn't thought. . . . But I suppose maybe it is. I wish—I wish I knew how to do more."

"You know, then? What it's like for them on Lansing?"

She nodded.

"I'm not much lookin' forward to it, myself, I've got to admit. But I've talked myself out of anythin' better—literally." He smiled. "I don't regret it. It was in a good cause."

She picked up a cup, set it down aimlessly. "What will you do, Wadie, on Lansing?"

He smiled again, hearing his name; the smile stopped when he remembered. "Sit and watch the world end, I suppose. All the worlds. Not with a bang, but a gasp."

"You don't have to, you know—"

He felt her touch him as though she had raised a hand. He shook his head. "Maybe I do. Maybe that's my penance, for pretendin' there was no tomorrow."

"You don't believe that?"

"I don't know." He shrugged. "I don't know what I believe any more." Only knowing that he was alive in a vast mausoleum, and afraid to look at death. "But I belong here, to Heaven; if that makes any sense. It scares the hell out of me, but I've got to see it through. But thanks." He saw her smile, disappointed.

"You can change your mind."

"Sooner than I could change Heaven. . . . Ironic, isn't it; that we began with everything, and Morningside with nothing . . . and look who failed."

"We almost failed too—more than once." Betha stared at the wall, looking through time. "So did Uhuru, and Hellhole, and Lebensraum. But we had help."

"From where?"

"From each other. Planets like Morningside are so marginal any small setback becomes a disaster . . . but they're the most common kind of habitable world; they're all like Morningside in our volume of space. But our worlds are within reach of one another; we set up a trade-ring, and when one of us falls flat, the rest pick it up, and put it back together. And that's how we survive. That's all we do; we survive. But it's enough . . . it'll have to be enough forever, now that our journey here has failed.

"We have our own ironies, you know. . . . Morningside was settled after a major political upheaval on Earth. Our nearest neighbor now, Uhuru, was settled by some of our former 'enemies' after their own empire on Old Earth fell. Need makes stranger bedfellows than politics ever did."

He laughed abruptly. "As the five of us should know."

"Yes . . ." She held him with her eyes, finger over her lips.

"If you'd come before the war, Betha, maybe the five of us would even be doin' some good. Heaven could have learned somethin' then, about sharing. Now it's too late; there's nothing left to share."

She shifted position again, wincing. "Wadie . . . you said the knowledge that put Heaven's technology where it was is still intact. That if you could rebuild your capital industry, you could still make the Belt work again, and it could be everything it once was. You said even the *Ranger* could make the difference. . . . What if—what if we tied you into our trading network? It's feasible, the distance here from Morningside isn't that much greater than the distances we already travel. If we gave you the means for recovery, you could give us what we wanted all along, a richer life, for all our

worlds—and you'd never have to see this happen again!"

He listened to her voice come alive with inspiration; felt suddenly as though the pain and grief had lifted from her mind only to settle in his own. "That's what I said. But I was wrong."

"Wrong?"

"We've gone down too far, we can't recover now; death is a disease that's infected us all. We'll never work together now, even to save ourselves."

"But if they could understand that there was hope, for all of them . . ."

"How would you make them understand? You've seen how well they listen—" He slammed his hand down on the bench. "They wouldn't listen at all!"

"No, they wouldn't. . . ." Betha began to smile, in misery, moving her head from side to side. "Wadie Abdhiamal—how did we come to this? You saying they wouldn't, me saying they would. . . . How could we come to understand each other better than we understand ourselves?"

He shook his head, felt a smile soothe his own mouth, lost his useless anger watching her.

Her hand moved tentatively from the desk to touch the leather band on his wrist; he caught her hand and their fingers twined, brown and pale. She looked across at him, down at their hands. She drew her hand from his again, said quietly, to no one, "And not one of them lived happily ever after."

***Flagship Unity* (Lansing Space)**
+ 3.00 Megaseconds

A raid. While he, Raul Nakamore, had been chasing the phantom Ship from Outside, it had run literal rings around him, and raided the very distillery his borrowed ships had been set to defend. While he was still locked into his initial—futile—trajectory toward Lansing, without fuel enough to make any attempt at further pursuit anything but a joke. Raul drummed irritably on the arm of his seat, having no better way to vent his growing frustration.

And yet, the reports he'd received indicated that the starship had not headed directly out of the system . . . indicated, in fact, that the ship might be tracking his own course and returning again to Lansing. Raul glanced at the instrument board, seeing 2700 kiloseconds elapsed, only 23 kiloseconds remaining before they reached Lansing. Like the fable of the tortoise and the hare—slowed by the stolen hydrogen, the starship would never reach Lansing before them, if Lansing was its destination. But why should it be? Why would these outsiders play pirate for Lansing, when they'd suffered losses in the Rings already? Revenge? . . . But they could have destroyed the distillery, easily; and instead they stole one thousand tons of hydrogen: Too little to cripple the Grand Harmony, too much for a ramscoop's drive.

And showing them how to steal it had been Wadie Abdhiamal . . . Wadie Abdhiamal of the

Demarchy. Outlawed by the Demarchy, Djem had said, voted a traitor by his own people for helping the starship escape them. And if there was one thing he, Raul, was sure of, it was that Abdhiamal was no traitor. Why had he betrayed the future of his own people, then? He might not be a jingoist, but he wasn't insane. Why would he threaten Snows-of-Salvation, when he knew better than any other demarch what it meant to the survival of both their peoples. . . . Why would he betray his friends? Because they had been his friends; and by betraying them he had cut himself off from the only haven he would have found in his exile.

Maybe he'd been forced into it. But Djem hadn't thought that Abdhiamal had acted like a man who had been forced. . . . Raul knew that Djem would never forgive Wadie Abdhiamal—for the betrayal of their friendship, if for no other reason. What was it about that ship, or whoever ran it, that would make a man like Abdhiamal willing to sacrifice everything? Maybe he would never know. But if that ship was following them to Lansing—

Raul stretched and turned to look at Sandoval. Sandoval sat with an expression of uncompromising boredom on his hawknosed profile, rereading a novel tape. A good officer, Raul thought. If he believed this use of his ship and crew was fruitless or pointless, he never let it show. Raul kept his own doubts private, and his own speculations. 23 kiloseconds to Lansing. And maybe they wouldn't be disappointed after all. . . .

The sight of Discus, shrunken almost to insignificance, greeted Raul as he pushed off from the hatch, drifting down to the stony surface of Lansing's docking field. He remembered looking up into a Demarchy sky, long ago, where Discus had been only a bright starpoint, one of a thousand scattered stars, and as unreachable as the stars. He remembered the feeling of isolation, and desolation, that had struck then. But this time, invisible now but much closer at hand, was the ship that he had left in low orbit above Lansing to insure their safety. He moved cautiously as he waited for the handful of crew from the two docked ships, easing tension and unused muscles; grateful, after nearly three megaseconds, for the return of normal gravity. Across the field lay three other ships. He studied them with a fleeting curiosity, realizing that even Lansing had the nuclear-electric rockets that the Grand Harmony didn't have; but realizing too that these ships were so deadly that even the Harmony would be better off without them. Below him (the angle of gravity's feeble drag put the term into his mind), the semitransparent plastic that shrouded nine-tenths of Lansing rock showed muted patches of green and gold, pastelled by the angle of his sight. He thought of drifted snow, the pastels of impure gases crystallized by cold.

This was Lansing, the once-proud capital of a once-proud Heaven Belt,

the only world of its kind. Its self-contained ecosystem had recreated Old Earth, and that was why its population had survived the war; and because, as a capital, it had been a showplace, and nothing more. He knew that Lansing had been reduced to piracy at the time of their last close pass with Discus; he wondered what they had been reduced to by now. His crew were nervous and hostile; he had given orders for them to remain suited even inside the asteroid, to isolate them from any contagion—and to isolate them from any other incidents that might come out of a face-to-face confrontation with the locals.

They started toward the single airlock visible in the hillside above the ships. Raul glanced on up at the solitary radio antenna on the crest of the naked hill. It was half illuminated by the cold light of the distant sun, sinking into shadow as the planetoid tumbled endlessly, imperceptably. No lights blinked along its slender stalk as a warning to docking ships. His radioman had been unable to detect any broadcast response from Lansing; he wondered whether their communications had failed entirely, whether they even knew his ships had landed . . . whether—like an unpleasant premonition—they might even all be dead.

One of his men turned the wheel on the hatchway sunk into the rock, he watched it begin to cycle. The men behind him waited, without eagerness, without relief, without any sense of triumph at having reached their goal. He heard only broken whispers, an uneasy muttering, picked up by his suit radio. Their silence surprised him until he realized that it was an extension of his own; as if isolation and the pall of death that shrouded the Main Belt like a tent shrouded this world had affected them all. The airlock hatch swung out. With a sudden vision of the yawning pit, the gates of hell, Raul entered the underworld.

The lock cycled again, replacing vacuum with atmosphere in the crowded space between. Raul felt his suit lose its armor rigidity, glanced back to be sure that no one disobeyed him by loosening a helmet. After nearly three megaseconds of uncertain reprocessed air, he knew well enough how strong the temptation was. He checked his rifle, settled it in the crook of his arm.

The inner hatch slid open. He looked through—into the staring faces of half a dozen men and women, frozen in disbelief. They had not, he gathered, been expecting him. He pushed through into the corridor, searching the frightened faces for a sign of leadership; taking in the filth, the patched and piecemeal clothing. He heard the startled curses of the men behind him, raised his own voice, "All right, who—"

A woman who might have been young or old moved away from the rest toward him, carrying something bundled in rags; he saw a sheen of tears filming her cheeks, her dark eyes fixed on him with peculiar urgency. He heard her voice, trembling,

". . . a miracle, it's a miracle—" Before he could react she had forced the bundle into his arms; she pushed off and disappeared down the sloping tunnel. Taken aback, he looked down at the ragged bundle and found himself holding a newborn child.The baby made no sound; when he saw why, he turned his face away. "Whose baby is this?" His voice hardened with anger, with denial.

One of the men moved toward him, fear still in his face, a kind of desperation dragging him forward. "It's mine . . . ours. Please—please, let me have it?" Something in his tone made the baby a thing. He stretched his arms; one sleeve flopped free, torn up to the elbow. His nails were outlined with black dirt, dirt filigreed the lines of his hands.

Raul held the child out slowly, uncertain. The father took it, almost jerked it from his arms; abruptly the man pushed through the circle of armed crewmen and caught the edge of the hatchway. He thrust the baby inside, his hand found the control plate, his fist struck it and started it cycling.

Raul saw Sandoval leap forward, but the man pressed himself against the wall, covering the plate, as the door began to slide shut. Sandoval's gloved fist caught him by the front of his shirt, ripping the rotten cloth; the man pushed him away with a foot. The hatch sealed shut as Sandoval tried to force his fingers into the gap. The light blinked red from green above their heads. "Why you—" Sandoval turned back, as two of his crew pinned the man between them.

"Sandoval!" Raul raised a hand. "That's enough. That's enough. . . . It was a—mercy killing. Let him go."

"Sir—" He saw Sandoval's rage trapped behind helmet glass.

Raul shook his head, putting aside the memory of his own three daughters and two sons, all grown now, and sound. He watched the father sag against the wall in slow motion as the crewmen released him. The man plucked mournfully at the drifting edges of his torn shirt, as though the tear was a death wound.

Raul glanced back down the tunnel, saw that the rest of the onlookers had disappeared. He moved toward their prisoner through the crew's muttered anger, through a ring of set faces. The man cringed and put up his hands, "I had to . . . I had to. Somebody had to do it; she knew that, but she wouldn't admit it! Everybody said so, it would've died anyway—wouldn't it? You saw it, it was defective . . ." He lowered his hands, reached out to grasp Raul's suited arm, "You saw it . . .?"

Raul's fist tightened against the urge to slap the hand away. He took a deep breath. "Yes, I saw it. It wouldn't have lived."

The man began to whimper, clinging to his sleeve. "Thank you . . . thank you . . ."

Raul shook him, roughly, caught somewhere between pity and disgust. "Who are you?"

The man looked at him blankly, stupidly.

"Your name," Raul said. "Identify yourself."

"Wind . . . Wind Kitavu." The man straightened, letting go of Raul's arm as reason came back into his eyes; aged eyes in a young man's face. "Who—what are you doin' here?"

"Askin' the questions. First, is anybody in charge here, and if so, can you take us to 'em?"

Wind Kitavu nodded, staring distractedly into the muzzles of a half dozen rifles. "The Prime Minister, the Assembly. I know where the chambers are. I'll take you . . ." His fingers searched the tear in his shirt again, drew the edges together nervously. "You aren't the—" Raul watched the question form on his lips, saw him swallow it. "You want me to take you?"

Raul gestured his men aside, letting Wind Kitavu pass, he followed, and the crewmen fell in behind him. He noticed that one of the prisoner's legs was shorter than the other, and twisted. *The gates of hell; the capital of Heaven.*

They were not led out onto the surface as he had expected. Wind Kitavu kept to the subterranean hallways, where dull-eyed men and women with stringy hair watched them pass, showing mingled fear and wonder, but mostly showing confusion. *No threat* . . . He felt his initial wariness settle into a bleak feeling of depression. A woman pushed out from the wall, moving with Wind Kitavu, ". . . starship . . .?" Wind Kitavu shook his head, and she drifted free, her face tightening. Raul saw despair in her eyes as he passed, and his spirits rose.

On his orders Wind Kitavu pointed the way to the communications center, and he sent Sandoval with two men to investigate. With the others he continued on, wondering what they would find when they reached the assembly chambers.

Whatever he had been expecting could not have prepared him for what he found. Someone had sent word ahead of their arrival: Seven figures stood waiting, tiny in a vast rough-walled chamber that he somehow instinctively knew must have been intended for storage, and not as a meeting hall. And like gem-crystals in a matrix of barren rock, the five men and two women shone, resplendent in robes of state. One man, Raul noticed, was still adjusting the folds of a sleeve tangled by haste. The nearest of them started forward, his drifting progress a ceremony, his face set in expressionless formality. Raul studied the intricacies of brocade, layer on layer, as the official approached: the fibers absorbed and enhanced light, sent it back at his eyes in a shower of scintillating fire. . . . He began to see, as he probed the wash of gemlight, the patches where it dimmed and faltered. The garments were stained and frayed, eaten by time. The man wore a soft, turbaned headcovering of the same material; his seamed face and gnarled hands, fading darkly against

the brilliance, were clean.

Raul waited silently until the officials reached him. The six assembly members, their own threadbare splendor muted, clustered slowly behind him. Their group stare rested on Raul's weapon rather than his face. At last the man lifted his gaze, searching Raul's helmet glass to meet his eyes. "I am Silver Tyr," the voice surprised him with its unwitting arrogance, "President of the Lansing Assembly, Prime Minister of the Heaven Belt—"

The man broke off, as laughter rattled in Raul's helmet; for a long second he didn't realize that it was not his own bitten-off laugh, that it had come from one of his crewmen. He raised a hand to stop it, hearing mentally the clattering mockery the chamber would make of the sound.

"And you are—?" The Prime Minister forced the words with rigid dignity—demanding respect not for an aging shadowman, ludicrous in the rags of lost richness, but for the undeniable fact of the lost dream-time, of what they all had been, once before their fall from grace.

"Raul Nakamore, Hand of Harmony." And almost unthinkingly he held out a hand, gloved against contamination but open in friendship, in recognition. "We mean you people no harm, we only want your cooperation while we're here."

The Prime Minister extended a hand, with the hesitancy of a man who had expected to have it lopped off. "And what have you come here for?"

Raul shook the hand, let it go, before he answered. "We've come huntin' pirates, Your Excellency," he dredged the unaccustomed title up from a half-forgotten history lesson. He noted the ill-concealed start of guilty knowledge on more than one face.

Seeing him observe it, the prime minister said, almost protesting, "But that happened almost a gigasec ago, Hand Nakamore—and it was an act of need, as you must know. Surely you haven't come all this way, after all this time, to punish—"

"I'm not speakin' of your last raid on the Rings, Your Excellency—I think you know that. I'm speakin' of a starship from outside the Heaven system, that destroyed one of our navy craft, and raided our main distillery—and is passin' by Lansing on its way out of this system . . ."

"Sir—" Raul heard Sandoval's voice, turned at the sound of more men entering the room.

Sandoval and the two crewmen joined his group, escorting an angry-faced woman. Brown skin, brown eyes, brown hair graying at the temples: Raul assessed her as she assessed him. He felt her anger flick out in a lash of wordless contempt as she glanced at the robed figures of the assembly. Her gaze returned to him, the anger cooling; he thought of a fire banked, controlled, still burning underneath.

"Sir, we found this woman in the radio room. She claims their comm's out of order."

He nodded; turned back as the prime minister said, "We know nothin' about a starship. You saw the only ships we've got, they can't even reach Discus anymore—"

"Face reality, Silver Tyr!" The sharp edge of the woman's voice slashed his words. "He can see you're lyin'; all of you, you couldn't cover the truth any more than those robes cover your rags. If he didn't know the truth before, he knows it now. The best we can do is cooperate, the way he says, and hope maybe he'll be willin' to bargain—"

"Flame Siva! Would you betray the only people in the universe who care enough to help us? And your own daughter—"

"No cripple, no defective, is a child of mine . . ." her voice betrayed her. Raul felt the heat of bitter disappointment in the ashes of her words. The sagging figure of crippled Wind Kitavu tightened in a flinch. "But that's irrelevant, anyway, under the circumstances."

A frown settled into the lines of the prime minister's face. "Two of our people are on board the starship . . . they say the Grand Harmony attacked the starship first; it has a reason and a right to retaliate against you, and you have no legal claim on it, in our judgment. We have no intention of cooperatin' with any attempt to seize it."

"I see." Raul matched the frown, realizing that there was nothing he could really do to these people, because he had already destroyed their only hope. "Fortunately for you, we don't really need your cooperation . . . but we won't tolerate any interference. We intend to wait here until that ship arrives—" he studied their responses; knew, with all certainty and a kind of callous joy, that it would. "One of my ships is remainin' in orbit above Lansing; if we encounter any resistance, the captain has orders to hole your tent. If you want what time you've got left to you, don't get in our way."

"Even on Lansing we don't run to meet Death, Hand Nakamore." The prime minister looked down, looking at his gun.

"Especially on Lansing," Flame Siva said. "We're Materialists, Hand Nakamore, realists. At least we're supposed to be." She paused. "Just what are you plannin' to do to that ship and its crew? Will you seize it intact?"

Raul laughed shortly. "That's what we'll try to do. But I'd disable it permanently before I'd let it get away from us again. And we want the crew alive, to show us how to run it. But if they refuse to let us on board—piracy is a high crime by anybody's law, punishable by death." He saw the assembly members shift, flittering.

"She's lost most of her crew to you already," the woman murmured, almost to the floor.

"She?" Raul said, surprised. "That's right—remembering a detail of alienness, and the detection of human remains—"She: a woman pilot. So her crew is shorthanded?"

"Two of our own people are with them," she repeated. He realized that it was more than a simple statement of fact: *her daughter*, the prime minister had said. Her hand rose, agitated; she brushed her neck, her matted hair, controlling a gesture he recognized as threatening. "The captain promised us the hydrogen we need to survive, if they helped her get it for her own ship . . . the hydrogen you wouldn't share with either of us, unless we took it by force from you."

He waited, not responding because she hadn't made it a challenge.

"What would you give us, if I helped you secure the ship intact?"

Surprised again, he asked, "What could you do to guarantee that?"

Thin hands crossed before her, locked around her thin arms; sleeves that were too long and too wide slid back. "Allow me to finish repairs on the radio . . . give me parts for it, if you have them," she glanced up, her eyes hard and bright. "Let me make contact with the ship when it approaches, to reassure them that it's safe to come in close, so that you can take them easily."

"We could do that ourselves."

"No, you can't. My—our people on the ship know the radio here, and its problems—and they know my voice. A stranger's voice would make them suspect somethin' was wrong . . . and so would radio silence."

"You may have a point." Raul nodded.

"Will you leave us the hydrogen if I do that?" No fire showed, this time.

"If the ship escapes, they can come back with the hydrogen!" Wind Kitavu burst out. "Don't take away our only chance—"

She turned, her face silenced him. Raul wondered what showed on it. She turned back. "Will you?"

Knowing how easy it would be to lie, he said, "I'll request permission. Maybe I'll get it; maybe I won't." He waited for her reaction, was puzzled by a kind of exasperation, as if she had wanted him to lie, wanted an excuse to perform treason. Or was it something else . . . He thought of Wadie Abdhiamal.

"But the crew, then? If you . . . take the ship intact."

"If I take them alive?" *Her daughter* . . . finding in that sufficient explanation at last. "So she does matter to you?"

Flame Siva started; her eyes were cinders, her voice lost its strength. "Yes . . . of course she matters . . ." and suddenly defiant, "They all matter! They're tryin' to save us!" She stopped, biting her lip.

Raul shifted lightly. "If they don't resist us, we'll release your daughter and the other one here; if that's what you want." *That'll be punishment enough.* "For the rest—there's a Demarchy traitor on board, who gave 'em the information to hit our distillery. I don't think he's left himself much of an option." *But I still want an explanation.* "And the outsider crew, what's left of it—they'll cooperate

with our navy, one way or another, I expect."

"You'll never let them go." Not a question.

"I don't think either the crew or our navy will ever be in a position to negotiate about that."

She nodded, or shook her head, a peculiar sideward motion. "We do what we can, here . . . and take what we can get. We're responsible for our own actions—" Again the defiance, the spite, the fire . . . she faced the ghosts incarnate of the Lansing assembly. "We take the consequences."

"Sandoval," Raul signalled him forward. "Take her back, let her work on the radio. And whatever happens, don't let her broadcast anythin', repeat *any*thin', until you get the word from me."

"Yes, sir." Sandoval saluted smoothly and led her away, her head high, flanked by guards.

Raul delegated two more men to guard the airlock, keeping one with him. The prime minister and the assembly members waited, aware once more—as he was aware of—their lack of consequence, their loss of control.

The prime minister turned to Wind Kitavu, his robes opening like a blossom. "You. What are you doin' down here like this?"

"You know what I was doin'." Wind Kitavu jerked into an arc away from the wall. "The baby. You all know, don't act like you didn't!"

The prime minister drew back, an undignified motion. "Then don't expect anythin' from us! You knew what would happen. Accept your own mistakes . . . get back to work." He stretched his arm.

Raul saw dirt still crusting it from wrist to elbow as his sleeve moved. He heard one of his crewmen laugh out loud again, seeing it; did nothing this time to check it. He turned away. "Wind Kitavu."

Wind Kitavu halted his sullen drift toward the door.

"Are you goin' out onto the surface?"

A nod, faceless. "Got to tell my—wife. Tell her about the baby."

"Then we'll follow you up. I want to see those damned gardens."

"Damned gardens." It echoed, someone else's voice; Wind Kitavu moved toward the exit. Raul did not turn back to acknowledge the prime minister of all Heaven Belt.

Raul followed his unresponsive guide through more tunnels, this time feeling the upward slant. Brightness grew from a point of light ahead of him, widening as he rose to meet it, an intensity of light that could only be the sun's. But this time he approached the day in the way that had been natural for the human species through the countless years of its existence; a way that for him was entirely novel and unexpected. He crossed into the daylight freely, easily, unhindered by any barrier.

And stopped, absorbing, absorbed by the blinding greenness that enfolded him as he emerged from the hillside. He had a sudden vivid memory of the hydroponics greenhouses of

the Harmony, the heat and humidity that made them a sweltering hell to the average citizen. His crewmen retreated into the tunnel's entrance behind him; he ordered them back sharply. Periodic hydroponics service was required of all citizens, a shared trial. He had done hydroponics service in his youth; but as a Hand of Harmony, it was no longer required of him. *Maybe rank does have its privileges.*

But the handful of ragged workers clustering now didn't look any more uncomfortable than the ones in the tunnels behind him. Insulated by his suit, he would never experience the reality of the gardens, of how life had been on Old Earth. Two futures waited here with him, in the balance of life and death—and either way, he would never have this opportunity again . . .

He looked back at the shifting knot of sullen, dirty faces, at the genetic deformities that marked them like a brand. Above them all, latticed and embroidered by the fragile looming trees, the roof of the sky was a transparent membrane, disfigured too by blotches of clumsy patchwork. Once there must have been something more, a shield of force to protect them from solar radiation . . . a protection that had long since been lost. In the Grand Harmony permanent hydroponics duty was given as a punishment. Here it was a punishment too, in a different way; for the crime of having been a victim . . . He left his helmet on, the idea of contamination back in his mind again: Not the contamination of disease, but a more pernicious contamination of the spirit. It was not a place he wanted to get the feel of, after all.

"What is it now?" One of them clutched at Wind Kitavu's sleeve, pulling his torn shirt halfway off his shoulder. "Are they wearin' *suits* to come out an' preach at us now?"

Wind Kitavu worked free, jerking his shirt back up his arm. "No—" his voice dropped, his hand gestured at them as he explained. Raul lost the words as an atmosphere in gentle motion hissed sibilance. He watched the lithe motion of the reaching trees, watched an expression that was growing too familiar spread from face to face in the group of workers, the desolation so complete that it could not even re-form into anger.

Wind Kitavu asked something in return, the man who had stopped him pointed vaguely away. Without asking permission, without turning even to look back, Wind Kitavu left them, disappearing between the shrubs, loosening a slow shower of pastel blossom petals where he passed. *The baby.* Raul made no move to stop him, remembering what it was he went to do and having no desire to be a witness to it. The other workers began to drift back and away, still watching him warily as their bare feet pushed off from the springy mat of trampled vegetation. Raul glanced back into the tunnel, still empty behind him. He noticed for the first time that the overhead lamps that illuminated the underground were flameless. Electricity . . . somewhere, these people had

a functioning generator, probably an atomic battery from before the war—or even from some later trade with the Demarchy. He considered again the fact that the Grand Harmony had none at all because of the Demarchy. If not for their bounty of snow, the Grand Harmony would be in a worse position than Lansing—and the only worse position was death.

The Demarchy made him think of Wadie Abdhiamal, and the mystery that lay behind their impending meeting. He had seen Abdhiamal function as a negotiator at Snows-of-Salvation: inexperienced, unsure of his own position, but wringing cooperation out of both sides with an instinct for fairness that dissolved cultural biases the way a heated knife sank through an ice block. And as a ship's captain he had transported Abdhiamal to meetings in Central Harmony and half the inhabited rocks of the Rings. He had seen the man ignored, insulted, actively threatened, but never losing patience . . . And he had been surprised, suspicious, and finally pleased, when Abdhiamal questioned him about matters of Harmony governmental policy. Pleased, in the end, because he saw Abdhiamal actually listen, and learn, and make use of what he learned to help them all.

The only weakness he had found in Wadie Abdhiamal was his inability to deal with one thing—the inevitability of Heaven's end. He had found that Abdhiamal believed some answer still existed; while he, Raul, like the people of Lansing, had seen long ago that the only answer was death. And yet he began to suspect that Abdhiamal's obsessive optimism covered a conviction as certain as his own that Heaven was doomed . . . but more than that, it covered a deep, pathological fear: Abdhiamal was not a man who could accept that all he accomplished would mean nothing, in the end. He could not continue on that road, knowing its end was in sight; he would stumble and fall, crushed by the burden of his own knowledge. And so some part of Abdhiamal's mind had shut the truth away, buried it in a lie that let him continue. Raul had envied Abdhiamal the Demarchy, where comparative richness helped him protect his illusions. And he had wondered whether anything would ever force him to admit the truth . . .

But the starship—even he, Raul, had discovered hope again in what it could offer Heaven . . . and, specifically, the Grand Harmony. Why would Abdhiamal, of all people, try to make sure that neither of their governments got its hands on the ship? Abdhiamal was a fair man—but was he fair to the point of insanity, of genocide? And the woman who piloted the ship . . . why would she run such risks, to keep a promise to a place like Lansing? Were they both insane, were they all? Or was there something he wasn't seeing . . . Too many things that he couldn't see. But *if* she kept her promise, if that ship was falling right into his hands . . . that was the only answer that he would ever need. Ever.

***Ranger* (Lansing Space)**

+3.18 Megaseconds

"Can't you raise Lansing, Pappy?" Betha moved stiffly up from the rendezvous program on the control board.

Clewell pulled the ear jack wearily away from his head. "No. I've got the ship monitoring all up and down the spectrum. If anyone talks to us we'll hear it."

"Maybe the transmitter broke down," Shadow Jack said. "It's out about half the time, seems like. They have a hard time keepin' it repaired." Bird Alyn floated beside him above Betha's head, gazing at the magnified image of Lansing on the screen. Betha watched the cloudy, marshmallow softness of the tent passing below; a shroud for dying people, who would live a little longer because of the *Ranger*.

Discus hung above and to the left, tilted and indistinct, a tiny finger's jewel. And somewhere in the closer darkness: three fusion ships from the Demarchy. Not one of them had begun deceleration to match velocities with Lansing and the *Ranger*. Their mission was one of murder . . . Betha glanced at the latest tracking update; less than ten minutes left to offload the hydrogen.

"Well, our time is a little limited . . . I'm sure that Lansing won't mind if we drop you and the tanks into low orbit, and then get ourselves out of here." She smiled up at Shadow Jack and Bird Alyn, forcing warmth into her voice. "They should be glad to see you two coming home with eight hundred tons of hydrogen."

"They will," Shadow Jack said. They nodded, their faces shining clean and smiling bravely above the collars of their pressure suits. "But . . . are you sure you're goin' to be all right when we go?" An odd longing edged his voice, and a secret shame. "Just the—two of you?" He glanced away at Clewell's drawn face, cracking knuckles.

Betha saw Wadie look at her, from the corner of her eye . . . impeccable Abdhiamal, in embroidered jacket and faded dungarees. She smiled, in spite of herself. "We'll be all right," managing a confidence her own aching, battered body did not really believe, for his sake. She would not play on his guilt to make him change his mind. They had come this far; they would find a way to do the rest, somehow. Later, she'd think about it later . . . "Don't crack your knuckles, Shadow Jack. You'll ruin your joints."

Shadow Jack grinned feebly and stuffed his hands into his gloves.

Wadie touched her shoulder. "Look."

As they spoke, the *Ranger* had slipped a quarter of the way around Lansing. On the near horizon, they saw a blunt protrusion of naked stone, the tent lapping its slope like clouds below a mountaintop.

"The Mountain," Bird Alyn said. "They're the radio antennas, an' the moorage . . . there's one of our—"

"Hey." Shadow Jack tugged at her

arm. "That's not one of our ships! I never saw anythin' like that; where'd it come from?"

"Maybe it's salvage . . ."

"No, look, there's another one—"

Betha increased magnification. "Pappy, those look like—"

"—Ringers! Ringers, go back it's a trap, a—" A woman's voice burst out of the speaker, was choked off.

". . . mother—!" A small cry escaped from Bird Alyn.

"Those look like chemical rockets, down there." Clewell finished the sentence, his voice like dry leaves rattling.

Wadie's hand tightened on her shoulder. "My God, those are Ringer ships; fifty million kilometers from Discus . . ." his voice sharpened with disbelief. "The Demarchy knew the Harmony had a couple of high-mass-ratio strike forces, but nothin' like this. To be here now, with only chemical rockets, they must've started after they first attacked you. And even then they'd need a mass ratio of a thousand to one—"

A new voice came over the speaker: "Outsider starship: This is Hand Nakamore of the Grand Harmony. Maintain your present orbit. Do not activate your drive, or you'll be fired upon. One of my ships will approach you now for boarding." Betha looked down on the airless mountain, at three cumbersome Ringer craft, each hardly more than a mass of propellant tanks surrounding a tiny crew module. At last she saw one of them begin to rise, its invisible backwash kicking up clouds of surface rubble. *Trapped* . . . her hands knotted at her sides. The best the *Ranger* could ever do was one gravity; and now she could only get one quarter of that, with the load strapped to its hull. The Ringer chemical rockets could do several gees, for more than long enough to close with them.

The seconds passed; the Ringer ship rose slowly, almost insolently, toward them. The minutes passed . . . and with them, the *Ranger's* last hope of avoiding the Demarchy fleet as well. *Christ, why must we lose now, when we're so close!*

Wadie hooked a foot under the rail along the panel, steadying himself. "Betha, that was Djem Nakamore's half-brother, Raul, on the radio. He's a Hand of Harmony, an officer in their navy. A high-ranking officer. Let me talk to him. He probably knows what I did at Snows-of-Salvation; but we were friends, once."

"Better wait, Abdhiamal," Clewell said quietly."We've got more company, sophisticated wideband—" He touched a switch and another segment of the screen brightened.

"Lije MacWong," Wadie said; Betha saw the easy grace tighten out of his body.

"Captain Torgussen: If you're receiving this, you must realize that the Demarchy has pursued your ship. The distance/velocity gap between us is small enough now so that you can't outrun our missiles; do not attempt to leave Lansing space." Behind MacWong's self-satisfied face Betha could

see a control room half the size of the Ranger's, and a ship's officer in a sun-gold jacket. Further back in the room she saw cameras trained on the screen, saw a cluster of demarchs, like bright-painted wooden dolls . . . company representatives, overseeing their interests. She saw Esrom Tiriki, felt her mouth tighten.

She signaled at Clewell to transmit. "I hear you MacWong. And I'm impressed. Have you actually come all this way just to destroy my ship? You can't take us now; all you can do now is destroy us in passing . . ." she hesitated. MacWong's startling blue eyes still stared blindly from the screen. She realized chagrined, that even closing at 800 kilometers per second the Demarchy ships were still millions of kilometers away; light itself took half a minute to bridge the gap.

At last MacWong reacted, looked past her to Wadie: For an instant she saw apology, and regret; another second, and she saw only triumph. "On the contrary, Captain Torgussen. We have no intention of destroyin' your starship—if you obey our instructions. Our ships will pass through your vicinity in about four thousand seconds. You have that much time to dismantle and deactivate your drive. If, by that time, you haven't satisfactorily proved that your ship will be immobilized till we return for it, you will be fired upon and destroyed. The people want your ship intact, Captain; but if they can't have it, they don't intend to let it go to anybody else."

Betha pushed back, her arms rigid against the panel. "Wadie . . . he's no fool after all." The *Ranger* lay in the jaws of a trap; and each jaw was unaware of the other. When the jaws closed on her ship, they would have to destroy each other too— She let go of the panel, forcing a smile. "Then I'm afraid you have a problem too, MacWong. We would have been gone before you arrived, except that someone else is already holding us here . . . Hand Nakamore, I'm sure you've been monitoring. Would you care to comment?" She waited, savoring the bitterness of useless satisfaction.

Clewell grunted. "The Ringers are transmitting video, not to be outdone . . ." A new patch of screen brightened with a black-and-white image. The Ringer control room was small, the crew strapped down to padded couches crowded by equipment: an image from the earliest days of space travel. A thick-set Belter in a helmet with the Discan rings for insignia sat nearest the camera, his face grim behind a stubble of beard. "This is Hand Nakamore of the Grand Harmony. My forces have seized the outsider starship, and if it attempts to comply with your demands, we'll destroy it. We have several prewar fusion bombs in our possession. If you attempt to keep us from takin' that ship, we'll do our damnedest to destroy you too."

Betha glanced at Wadie, questioning.

"He could have the bombs; salvage

from the war." Wadie studied the embroidered words on his jacket front. "If he could maneuver into MacWong's path with them, he wouldn't have to be too accurate, even if it took the Demarchy crews a megasec to die of radiation poisoning. Things like this happened during the war, crews of dead men fighting their final battle. That's how we got three fusion craft intact . . ." He raised his eyes. "Nakamore will never let the Demarchy take the *Ranger*, even if it means he has to die too."

Betha saw the trace of consternation that betrayed MacWong at the sight of Nakamore; the obvious disbelief on the ruddy face of the ship's officer, and on the face of Esrom Tiriki. She watched them change again to hatred and defiance, heard MacWong begin an angry response.

"And so we're all going to die, and so are they and so is Heaven." Her voice rose, "And for what? This is insane—"

"Don't you think they know that?" Wadie moved toward her, almost touched her again. "They know it, as well as we do. But they're trapped here just like we are; all that's happened in the last two and a half gigasecs since the War, all the frustration and fear, has been leadin' down to this. . . . It had to end like this. Your own song says it—'no one ever changed a world'."

She drew away from him. "It's the people who have to be willing to change! It didn't have to end like this. If they could have seen that there was still a future. . . . There could still be one now, but even you can't see it; you won't see it. You're right, death *is* what you want. . . . Suicide is the ultimate selfishness, and I've never seen a people more ready to commit it." She unstrapped, pushing up out of her seat and away from him, her breath catching at the punishment of sudden movement. "You deserve it. Damn you all—!"

He caught her wrist. Furious, she felt Shadow Jack move out of her way, staring, as Wadie pulled her back to the screen. "MacWong, Raul, this is Abdhiamal. I want to talk to you."

Nakamore acknowledged him, and Betha thought she saw a smile; she waited, saw MacWong break off his speech: "Sorry, Abdhiamal. You're a dead man. You've got nothin' to say to the Demarchy." MacWong glanced sideways, barely turning his head. Betha looked past him at Tiriki.

"We're all dead men, unless you listen to me! Because of this ship, which you don't have any more right to than Nakamore does, or I do. For God's sake, MacWong, there were seven people on this ship, who came three light-years from another system to Heaven; and five of them are already dead because of it. And now you're goin' to destroy the rest of them, along with the best ships left to the Demarchy and the Rings? You're all that's left of Heaven Belt, and your own greed is ripping your guts out. You're killing yourselves, because you're scared to die. Taking the starship won't save Heaven, and it's goin'

to finish you off instead, if you let it, you know.

"But you don't have to let it happen." He nodded at Betha waiting beside him, silent with surprise. "These people came to trade with us because they wanted a better life. And in spite of what we've done to them, they're still willin' to trade. There's a whole trade-ring of worlds out there, holding each other up so that they never fall into the kind of trap we've put ourselves in. They can save us too. Heaven Belt can be all it ever was, if we join them." He waited, searching the screen for a response. "Let the starship leave Heaven, instead of destroyin' it. You'll accomplish the same goal, but you'll have everything to gain and nothing to lose."

"You always could convince Djem that cold was hot, Wadie." Betha looked for mockery on Nakamore's face, was surprised when she didn't find it. "But this time you even make sense to me. . . . I don't *want* to destroy the starship, or my own ships. If I could get out of this bind by lettin' the ship leave the system, I would. The way things have turned out, it'd be enough just to put the ship beyond everybody's reach. . . . And the point's not lost on me that the only reason we've got you now is that this woman, this Captain Torgussen, came back to Lansing like she said she would." Nakamore found Betha's eyes, curiously respectful, "I think you would come back to help us too."

Betha frowned in sudden pain, bit her lip.

"I'm willin' to let you go, Captain. But is MacWong?"

Betha saw MacWong surreptitiously rolling the lace on his shirt front, still listening to Nakamore's transmission. Behind him the mediamen transmitted to his own every move, his every word, to the waiting Demarchy: MacWong was pinned under the public gaze like a bug under glass. At last he said, "Your suggestion violates the Demarchy's mandate for this mission. I only have the authority to seize the ship or destroy it; I can't let it go."

"Even though you want to! Even though we all may die if you don't . . ." Nakamore's words burned with contempt; his taciturn face was abruptly transformed, as though he were making a speech. Betha realized suddenly that he must be well aware that there was an audience waiting to receive it. Wadie began to smile, almost wonderingly. "You puppet. You call the Harmony a 'dictatorship', but we give more freedom to the individual than your people's mobocracy ever did or ever will. I have the power, the freedom of choice, to stop this stupidity. But you don't: Your people don't trust a man to use the judgment he was born with, they pick the words every time you open your mouth.

"But how are they goin' to tell you what to do this time, MacWong? They never imagined needing second-to-second control over hundreds of millions of kilometers, across a comm lag like this. By the time the whole Demarchy hears this, and debates, and

amends, and votes, things will be all over for us, and whatever they wanted won't mean a damn thing. . . . But you won't take the decision in your own hands because you're too afraid of the system, and of those pretty-boy anarchists behind you. The basic weakness and inefficiency of your self-servin' mob rule will make the Demarchy destroy its own ships, and mine, and destroy this system's last hope of survival. I've always known your 'government' was a farce . . . an' even you can't deny that now. I'd laugh, if it wasn't such a tragedy. Because that's what it is, a tragedy."

Betha watched impotent rage fracture MacWong's mask of complacency, saw real emotion for the first time on the faces of the listening demarchs behind him . . . saw the mediamen recording it all, so that the entire Demarchy could see and share their indignation. MacWong covered his anger. "Captain Torgussen, our ships will pass you in thirty-six hundred seconds. If you intend to follow our instructions, I suggest you get in touch with us soon." His image vanished abruptly.

Betha said softly, "Try to monitor MacWong's communications with the Demarchy, Pappy; let me know how much worse that outburst makes things."

Nakamore loosened the upturned collar of his stiff, bulky jacket, the anger flowing out of his eyes and voice. "He'll be back, I expect."

"My congratulations . . . your promotion to Hand, Raul." Betha watched Wadie bow, inscrutable.

"My duty, to accept; my desire to serve." Nakamore gestured the honor aside, oddly embarrassed. "I wish I could say the same to you, Wadie. But I don't know the Demarchy's etiquette for its traitors."

Wadie smiled bleakly. "There's not any."

"You're the only reasonable demarch I ever met, and that's probably why the mob went after you. I don't approve of your act of piracy against the Harmony . . . but I think I finally begin to see why you did it; why you want to help these people. I doubt if Djem'll ever understand it—"

"I know . . . and I'm sorry. There wasn't any other choice. It would never have happened, if—"

"If we hadn't attacked the starship when they first appeared? You're right. It was stupid of us. If we'd had sense enough to direct 'em to one of our bases instead, the Grand Harmony'd have its own starship now. But we didn't, and all we got was death. But we knew the ship was damaged, and Central Harmony figured it was worth the gamble I could catch them here."

"That was a long chance," Wadie said. "You'd have been a long time gettin' home, if what we saw is all the propellant you've got left."

"I know . . . Even without a battle, it would take us twenty megasecs to get back to Outermost—if our life-support systems held out. And then we'd freeze our asses off on that snowball, waitin' for a fuel shipment to get us to the inner Harmony." Nakamore

scratched his chin, looking tired. "But we took on food and air down on Lansing."

Shadow Jack pushed past Betha's shoulder to the camera. "Why didn't you just rip the tent and kill 'em quick, you bastard!"

Nakamore shrugged. "Boy, you're all pirates to me. But we didn't take that much. Look on it as a trade for the hydrogen you stole from the Harmony."

"Where's my mother?" Bird Alyn cried suddenly, shrill with anguish. "What did you do to my mother?"

Nakamore peered at her blankly; Betha saw comprehension come to him. "So. . . . Your mother's goin' to have a stiff jaw for a few hundred kilosecs. But aside from that she's better off than you are—or we are—right now. Speakin' of which: Captain Torgussen, you have my permission to off-load those gas cannisters into a low orbit around Lansing. Then I recommend all our ships move out a few hundred kilometers into space. When the Demarchy forces arrive the fireworks'll be lethal over quite a volume; there's no reason why Lansing should be part of it. Somebody might as well get somethin' out of this." He turned away, issuing soundless orders.

"Thank you," Betha said. She saw the curious smile still on Wadie's face as he watched the screen. "What is that man? I don't understand him."

Wadie turned toward her and the smile grew gentle. "Sanity hasn't entirely disappeared from Heaven, Betha. Not even from the Rings. . . . Raul is a decent man; but more than that, he's not stupid. I told you his brother never won a chess game from me. In all the time I spent in the Rings, I only won two games from Raul. He may still have some surprises left."

Betha rubbed her arms. "All I know is that he intentionally infuriated the Demarchy, to the point where they'll never be satisfied until they see us all in hell. Whatever he thinks he's doing, I don't like being his pawn."

The *Ranger* moved slowly out from Lansing. Betha watched it growing smaller below them, a world of elvish beauty, rising and falling in soft undulations beneath a transparent film of

plastic spotted milky patchwork. Trees reached upward toward the tentlike sprays of lace, fragile fountains of leaves spilling over fields of ripening grain . . . and fields of dying grass. She saw the velvet green parklands, still well-watered . . . and the peeling mud of dried marshes. The people below moved in a dream ballet among airy minarets and pillared buildings of state, on the world that had once been the symbol of Heaven's splendid extravagance. The last world she would ever see . . . She glanced at Clewell's still face, his closed eyes, where he drifted in his seat listening for the Demarchy's response. Afraid of the stillness, she looked away again; stroked Rusty's purring, clinging form while she tried to picture the other beloved faces already lost to her, and the homeworld none of them would ever see again. There was no comfort now, no satisfaction, in this ultimate revenge that Heaven would inflict on itself in retribution for their deaths. A terrible weariness settled over her, the futility of the last few weeks, the last four years.

"Betha . . ." Wadie kept his eyes on the screen. "I don't know how to save this ship. But I think I know how to save our lives. We can leave the *Ranger*, use the *Lansing 04* to take us down to Lansing. All Nakamore wants an end to is the ship, not our lives. If we use our suits we can all make it."

"No." Betha wrapped her arms across the aching muscles of her stomach. "I won't leave the *Ranger*. But yes, the rest of you, get into your suits and go. There's no reason for you to stay; at least save yourselves."

"What do you mean, you won't leave this ship?" Wadie pushed back from the screen, caught her chair arm. "It's just a ship, Betha; it doesn't control your life. You aren't chained to it."

She shook her head. "You still don't understand, do you? After all this time. This is *my* ship. I was part of its design, and part of its construction. Its crew were the people I loved; this journey meant everything to us, the future of our world. Everything about it binds me to my people, my past, my home. I can't leave it. I don't want to lose everything, I don't want to live forever in the place where it happened. I don't want to live like that."

"Now who's indulging in the ultimate selfishness?"

Her mouth tightened. "It's not going to hurt anyone but me—" realizing as she saw his face, that that wasn't true.

"Well, what about . . . what about Clewell?"

"What about me?" Clewell opened his eyes, irritably, at the communications board. "I have no intention of leaving the *Ranger* for that overgrown cinder down there."

"Damn it, you're just makin' her more stubborn. Why the hell don't you tell her she's wrong?"

"She's my wife, not my child. She has a right to make her own decision. And so do I . . . I've lived too long already, if I've lived to see this day.

My body already knows the truth." He closed his eyes again. "Now, let me do my job; monitoring the Demarchy is hard enough as it is, at this distance."

"May it do us some good." Wadie pulled himself back to the panel, massaged the cramped muscles of his neck. "All right, then. . . . I'll stay too. I guess I've earned the right. I lost everythin' I ever valued because of this ship."

Betha froze her expression, willed emotion from her voice. "You won't blackmail me into changing my mind, Wadie."

He bowed solemnly. "Not my intent. Allow me the privilege of making my own decision, since you expect me to accept yours. I'd rather die a martyr than a traitor."

She sighed, her nails digging into the palms of her hands. *Thank you.* "All right, then. So only two will be going to Lansing."

Bird Alyn raised her head from Shadow Jack's shoulder, drifting, cradled in his arms. "No. Betha, we're not goin' . . ."

"Now, listen—"

"No." Shadow Jack said. "We did what we wanted to do for Lansing. But there's nothin' anybody can do for us. We'd rather be—together—now, for a little while, than be apart forever." He glanced at the doorway.

"I see." She nodded once, barely hearing her own voice. "Come here, then, both of you." They drifted together, obediently. Betha worked a golden band from one finger of each of her hands. Reaching out, she took their own left hands, one at a time, slipped a ring over a thin straight finger, a thin crooked one. She joined the hands, to keep the rings from floating free. "By my authority as captain of this ship, I pronounce you husband and wife . . . May your love be as deep as darkness, as constant as sun."

Their hands clung to her own for a moment; she felt Shadow Jack's trembling. She turned away, heard them leave the room, Clewell's eyes touched her face in a caress. "Pappy get off the radio a minute. We've got to leave those people some hydrogen. . . ."

There were 1700 seconds until encounter.

Three hundred kilometers away now, Lansing was a greenish, mottled crescent on the darkness. Far enough away, Betha hoped, to survive whatever fires must burn across Heaven. On all sides emptiness stretched, filling the light-years to the distant stars. And the *Ranger* had been built to bridge those distances, at speeds close to that of light itself. But it would never cross them again . . . it lay stranded like a beached cetoid on the desolate shores of Heaven, trapped by primitive ships with primitive weapons, in the ultimate irony of defeat.

"Five hundred seconds," Wadie said. Rusty curled serenely in the crook of his arm and washed a protruding foot.

Betha lit her pipe, inhaled the famil-

iar, soothing odor of the smoke. "That's when the first ship will pass; they're strung out at about one hundred-second intervals. But it doesn't matter . . . we can't comply with MacWong's demand now."

Clewell chuckled suddenly, oblivious.

"God, Pappy, what in hell are you laughing at?"

He shook his head apologetically. "At the Demarchy reacting to Nakamore's speech—their righteous indignation, at being named for what they are."

"Well, put it on," Wadie said, strangely eager. "I want to hear that—"

A burst of static mixed with garbled speech filled the room. Clewell lowered the volume. "Sorry; even with enhancement, it takes some practice to make sense out of that."

. . . *400 seconds*

He pulled off his ear-jack. "My God, Betha, I think they're actually trying to take a vote . . . a vote on whether to let us go."

Betha pushed up out of her chair, caught herself on the panel edge with a gasp. "Pappy! Can't you clean up the transmission?"

"I'll try. MacWong's ships are close enough now; we may be in the tight beam from the Demarchy." He put an image on the screen; Betha saw print, illegible through snow, recognized the format of a Demarchy general election. A band of golden yellow brightened at the bottom.

"It takes about five hundred seconds for a full tally."

"Five hundred! Christ." She felt Wadie move close, his sleeve brush her arm. "Pappy, raise MacWong's ship."

"I've tried. They're not talking."

She could almost see the numbers, almost see them change. And beside the static-clouded picture, the *Ranger's* displays projected the track of three closing ships on a star-filled sky. Three ships that stood out like flares now, their torches extended ahead of their flight, decelerating at last. She searched their brilliance for a smaller track, a seed of blossoming destruction. *Give us time, MacWong*—Clewell left his seat, moved slowly along the panel to her side; she took his arm. The digits on the chronometer narrowed, like sand in an hourglass, eroding their lives. One hundred seconds until the first ship passed . . . sixty . . . fifty . . . She realized she had stopped breathing. "They're holding off! Forty seconds, that first ship can't fire on us now."

MacWong's face appeared below the tally. "Captain Torgussen." They saw the stress on his face, and on the faces that ringed him in. "We're just now receivin' the results of a vote from the Demarchy. The majority accepts your aid to Lansing as evidence of your good will, Captain, and favors a modification of our mission. . . . I hope you're listenin', Nakamore; you've just seen a demonstration of the real flexibility and strength of the people, the wisdom and fairness of the Demarchic system." He looked away,

into the media cameras and back.

"Captain Torgussen, the Demarchy will allow you to depart—if you will assure us that the Demarchy will be the center for distributin' your aid when you return to Heaven." His eyes asked her to promise anything.

On the center of the screen Betha saw the second Demarchy ship fall past them.

Nakamore's image came onto the screen. "You know I can't accept that, MacWong." His voice was even, no longer reaching out to goad an entire people. "I don't demand that control goes to the Harmony. But it's not goin' to you."

Betha froze, realizing that Nakamore might still let them go. A promise at knifepoint was no promise at all . . . And no solution. There had to be a way to reach both sides, or the next Morningside ship to come to Heaven would fall into the same deadly trap of greed. She heard someone come up behind her, turned to see Shadow Jack and Bird Alyn, peacefully hand in hand.

"What happened—?" Bird Alyn brushed her soft floating hair back from her eyes and blinked at the screen.

Betha turned back to the screen, saw MacWong's pale eyes search her face for an answer. "It's going to be Lansing: Tell your people, MacWong, Nakamore. Those are Morningside's terms: our aid will be distributed though Lansing, the capital of the Heaven Belt. Neither of your governments will be shown favor, everyone will be treated equally."

They stared at her, unreal images; she saw Tiriki come alive, saw his mouth move soundlessly, ". . . a trick . . . want that ship destroyed . . ."

Wadie leaned past her. "Lansing's harmless, Lije! The Demarchy will accept it; you know they will—"

MacWong moved back from the screen as Tiriki caught his shoulder; Betha read Tiriki's hatred. She looked at the computer plot. "That last ship will pass at only thirty kilometers; they can fire on us almost point-blank." She nodded at the screen, "If we don't see that ship pass by, we'll be stardust. . . ."

Behind her Shadow Jack said solemnly, "You mean we'll be dead."

MacWong broke away from Tiriki's grasp. She couldn't see his face, but only that he faced the media's glaring eye, and gave an order . . .

Nakamore began to laugh. "Thank you, you son of chaos!"

A barely visible streak of palest violet lit the darkness on the screen before them, for the length of a heartbeat, and was gone. The third ship had passed.

***Ranger* (Lansing Space)**
+3.15 Megaseconds

"Crops may wither on the plain
Sun may parch us, rain turn wild—"

Clewell strapped himself into the navigator's seat, feeling new strength and satisfaction fill the hollow weariness of his limbs. He looked down at the running reflections on the panel,

Shadow Jack holding Bird Alyn in his arms as she serenaded the long-suffering cat in midair across the room,

"Sharing brings us help for pain . . ."

The representatives of Heaven Belt: Clewell smiled, seeing them many years older and wiser, many years into the future, returning again to Lansing. "I never thought I'd be saying it, but I may just live another sixty years."

Bird Alyn braced her feet against the wall to peer sideways at him. "I can't believe it's real, Pappy. How did it happen, how did it all come out like this?" Shadow Jack kissed her cheek; she giggled.

Wadie pushed away from the viewscreen, where Lansing lay before them on the now-empty night: a chrysalis, waiting for rebirth into a new life cycle. "Nothin's gone right in Heaven Belt for two and a half billion seconds, Bird Alyn. There are a hundred million corpses out there, and God knows how many people who've gone through living hell. . . ." Bird Alyn's smile faltered; Shadow Jack held her tighter, the past darkened their eyes.

Wadie shook his head. "We must have paid for our mistake by now, a thousand times over. It's about time we had some good luck, damn it! It's about time."

Their faces eased. Clewell saw Betha look up from the panel, covering other memories, other sorrows. "Yes, it is Pappy," her voice was even, "everything's secured, the sky is empty. Start charting our course; it's time to go home." Wadie moved back to her side; Clewell saw his hand lift, hesitate and drift away, still uncertain. He had been beside her for days: helping, learning . . . watching Betha Torgussen, with an intentness that had nothing to do with starship technology. The man who would be a hero someday, when their ship returned, MacWong had said; but who for now was still a traitor . . . and the only trade consultant who would satisfy both the Demarchy and the Rings. A good man, Clewell thought; the right man. Like another good man who had loved his wife, and been his friend.

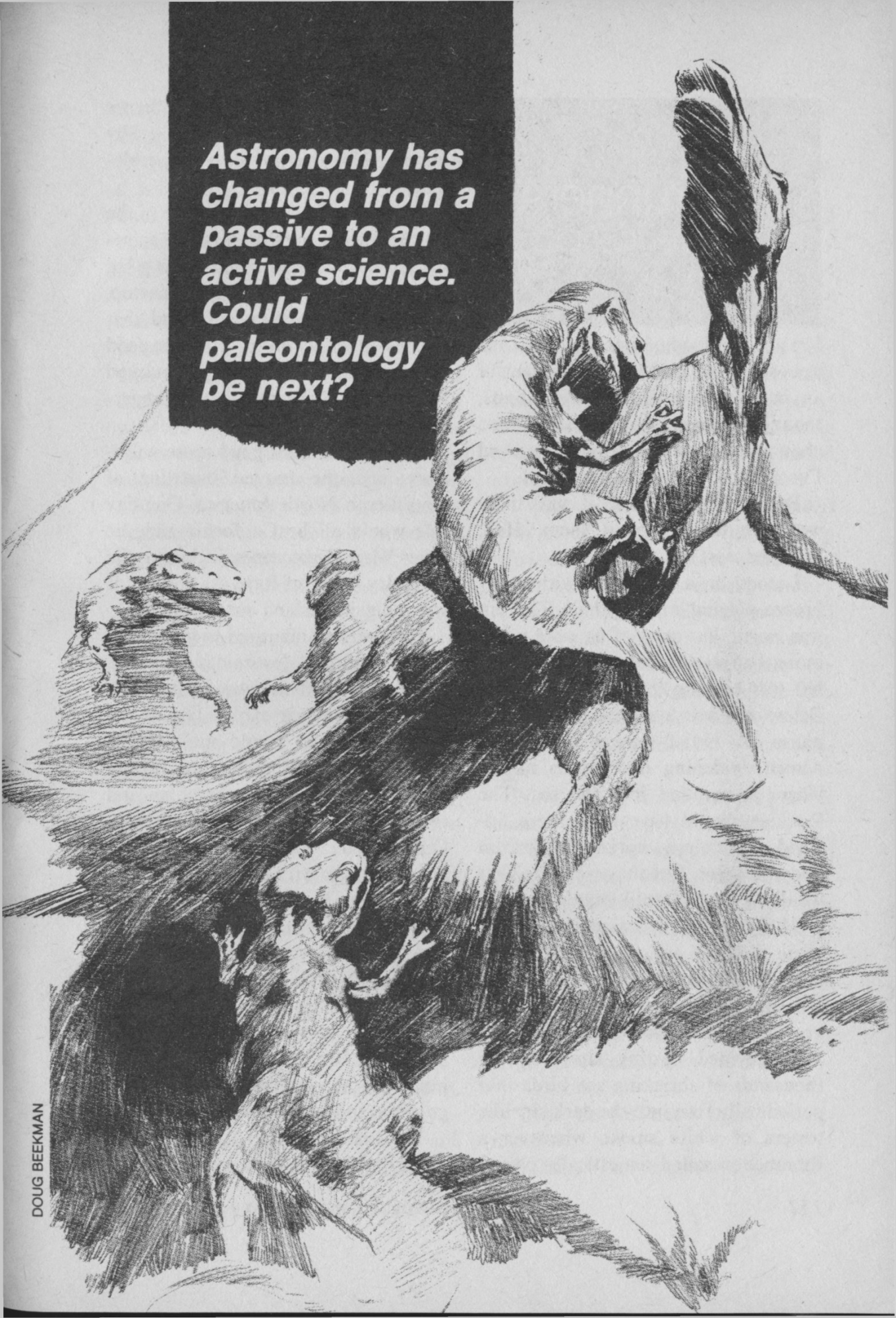
Clewell felt Betha's eyes touch him once more, as blue as field flowers, still shadowed by memory and pain. *Time heals all things* . . . and they would have the time they needed, now. She changed the image on the screen. It showed him numberless stars; and one among the millions—shrunken, red, and constant—that would guide him home.

Laughter floated out of the room and down the stairwell as Bird Alyn and Shadow Jack, unknowing and unconcerned, put the past behind them forever.

Rusty settled onto his shoulders, purring in soft harmony with the memory of song:

Sharing brings us help for pain,
For nothing's easy, oh my child.

He saw the faces of his other children, who he hoped would live to see the better world that had cost so much, and been so long in coming. "Rusty," he said quietly, "it's about time." ■


Astronomy has changed from a passive to an active science. Could paleontology be next?
DOUG BEEKMAN

the runners

BOB BUCKLEY

I'm not that fond of dinosaurs. The big ones smell bad and haven't the wits of an insect, while the smaller beasts, though brighter, would just as soon chomp off an arm as grin at you. And I've never seen one of them grin.

But, as impossible as it was, there we were down among them. Hell, revisited, sort of.

I stood on a clay bank with a dry breeze playing with my hair. The sun was warm, but none of us wore much more than shorts, and a wide-brimmed hat was keeping my brain uncooked. Below me was a river. A broad expanse of bluish-brown water, unnamed, widening here at its mouth where it emptied into the sea. The Rockies should have been there, instead of a choppy, horizon to horizon body of water. But they weren't. That wouldn't happen until later.

The waves were stained brown for some distance out. The channel carried a lot of sediment, and a considerable delta had been built up. Mangrovelike trees covered the sandbanks and provided nesting sites for the thousands of shrieking sea birds that periodically rose into the dark sky like towers of white smoke whenever a Pteranodon sailed majestically past. I think they are Pteranodons. James says they aren't. He should really know. He's one of the paleontologists.

Barely visible above the curve of the purple misted horizon was the snow-capped cone of a volcano. It was a big one. Rogers has named it Feathertop, for the cumulus plume of cloud that sweeps off its north ridge. It is as good a name as any other, and I've marked it as such on the map we're preparing.

Beyond Feathertop are more volcanoes, and the rugged coastline of Cordilleran North America. One day this would all be California and the other West Coast states, including the long, dry finger of Baja. At present, it was a gigantic island continent.

How we had managed to get all the way back to the Mesozoic is classified, and, in an unofficial accounting such as this I doubt my explanation of the physics involved would make much sense, anyway. I'll leave it to say only that we didn't use a time machine, and that Jupiter had a lot to do with it. Our vehicle was a very ordinary freight shuttle with a high thrust kicker bolted on her stern. An automated fuel barge had accompanied us. We had left it in synchronous orbit over cratonic North America. Getting back, according to the physicists, would be much trickier than our dropping back. But the pay was indecently high, and the computers said it was possible, so we went.

The first crew back had made the trip by accident. They were gone for

fifty-two subjective years. They had been eating dried lizard meat for so long that they had actually developed a taste for it. But, if they could get back knowing absolutely nothing about the Jovian Twist Effect, we surely could.

It was our job to map the terrain, and document the interval of temporal transfer. Our crew was small by necessity. Rogers was a geologist, and Jack and James were paleontologists. I was the pilot. But I had gotten this berth only because I had majored in animal behavior before going on for an advanced degree at an astronautics academy. I wore three hats, actually. I was also the camp astronomer.

All this just to determine what year it was!

We were completely on our own. No calm banter with Mission Control. No encouraging messages from the wife and kids. We were the only primates on all of Mesozoic Earth. I guess we should have felt proud, or scared, if we were smart. But, mostly, we were too busy to feel anything but tired.

I had set the shuttle down on a lofty plateau of Precambrian basalt that reared out of the continental platform like a giant's black bench. Sixty million years later it wouldn't be there. Erosion would have spread it out across the surrounding valleys as a fine, dark sand.

There wasn't much growing on it. The crevices had captured a few scanty drifts of soil, and here and there groves of cycads had taken root. Some of them were huge, and even the little ones appeared ancient.

James said they were related to the Dioons.

We also discovered that they had spines that raised welts whenever they stabbed the skin as we unloaded the copter from the shuttle's hold. After we had finished, and I was examining the shuttle's air-cushion landing gear for damage, James strolled up with some kind of pterodactyl flopping limply in his hands. He was examining it with a delighted, though bemused expression on his face.

"Well, what is it?" I demanded with mock seriousness. On the long trip out we had argued extensively about how closely twentieth century reconstructions of dinosaurs would match the reality. I personally doubted that we would recognize very much of the environment. The very nature of fossilization tends to present a skewed reconstruction of an ecology.

Now, seeing James and his puzzlement, I couldn't prevent a grin.

The creature was a light tan in color, covered with a very fine fur almost like felt. The jaws were long and toothy and protected by a beak of horn. The right wing was torn.

I took his prize away. The corpse was still warm. I palpitated the body and discovered what appeared to be a large insect secreted in the crop.

"It's a male."

"How do you know that?" he demanded.

I flicked the bright red, partially

inflated wattle that grew from the back of the throat.

"This is a display organ. Since your pterodactyl filled a birdlike niche in the environment it's reasonable to assign birdlike behaviors to it. If you look around you'll probably find a nest hidden somewhere close with a female brooding young. I doubt infant pterodactyls could maintain their body heat any more than young birds can."

James took back his once-living fossil, giving me a wounded look. He didn't say anything. But later, I noticed him wandering about the rocks, peering closely at the ground.

That afternoon, with Jack assigned to monitor us from the bridge of the shuttle, we left the river and the plateau behind and followed the sea coast north. This trip would provide the raw data for our dating of this time.

Rogers piloted. I was the spotter, and James sat beside me with a microfile whose memory was stuffed with reconstructions and skeletal overlays of every life form discovered to have existed in the Mesozoic. By keeping a tally of the spotting we would develop a fauna which could be related to a sedimentary unit. That would give us a crude date. Astronomy would provide the fine tuning.

Rogers kept us low over the beach. The sand was white. Beyond it was a low plain with a lot of ground cover. Here and there we saw animals. Generally the neck and upper body. Can't make much of an identification from that.

We crossed a shallow bay where a Mosasaur rolled below us and sounded again, and James began to look frustrated. The next few hours didn't get much better, and it began to seem as though the only way we might make a positive identification would be to catch one of the big beasts and X-ray it so as to match its skeleton with the fossil examples.

When I said this aloud James got an odd gleam in his eye, and I knew at once that I had made a serious mistake. I didn't want to see the three of us wrestling with six tons of angry dinosaur, and quickly explained the difficulties of such a feat.

"We have our guns," James countered.

By 'guns', James meant tranquilizers. We had orders to avoid killing. Dinosaurs were a dead line, without ancestors, but the experts didn't want to take chances. The tranq guns were bulky and badly balanced, but they used an electronic sight that couldn't miss and a microcomputer to optically weigh, type, and select the proper formula and dosage of tranquilizer for a target.

Knowing this, James was all ready to start hunting.

Rogers, to my relief, pointed out that the carrying capacity of the copter was limited. I provided the telling point by suggesting we head inland. The upland environments were known to be the habitats of Ceratopsians, and these giant grazers were well documented across the upper Mesozoic.

Rogers gained altitude and we

whirred off toward what would some day be Montana.

Eventually the sea faltered, giving way to saltflats and badlands. There were brackish swamps in the valleys, with a lot of bones gleaming on the islands, but apart from some yellowish, sickly reeds, nothing living. Even so, James wanted to land.

Rogers refused and pointed out a scaly lump sheltering behind an eroded outcrop of limestone.

It was a carnosaur. Young, only slightly larger than the copter, scrawny as death, and sleeping. Times had been bad for the beast. Its hide was tawny brown, with streaks of green that might have been pigmentation, or some exotic disease. There weren't any of those funny little ridges on its back like the monsters in the holos have. But he did have a brightly colored dewlap crumpled under his throat.

"Probably a male," I told James.

He sighed. Images were fleeting across the screen of the microfile.

About that time the flesh eating dinosaur woke up. He raised his head slowly and peered about the raw landscape with rheumy, bloodshot eyes. He looked like all the hangovers in the world rolled into one thundering headache.

I guessed that his good living had dried up a long time ago, and now even the dregs were gone. If we had passed this way one week later the scavengers would have been exploring his bones.

Awkwardly, using his forelegs as props, he pushed himself up into a standing position. His long tail thrust stiffly out behind like the balancing pole of a wire walker. Snorting, he took a couple of shambling steps toward the copter. Our downblast was kicking up a miniature gale. It blew dust and rattled the reeds in their beds of dried mud. Nothing like us had ever appeared in his world before. But movement had always equated itself with food and he was hungry enough to eat whatever came within reach of his jaws.

Meanwhile, James had stopped fiddling with the microfile.

"I believe it's a variety of Dryptosaur. It's certainly not an Allosaur, or Ceratosaur. Of course, the juvenile characteristics are confusing. We've only discovered adults in the record."

"Dryptosaurs are Upper Cretaceous, aren't they?"

"This could be a stem variety. He's pretty generalized. Might predate Tyrannosaurus."

As the carnosaur neared, Rogers lifted the copter higher.

"Why don't we try to lead him out of this death trap?" he asked.

I vetoed that suggestion. "We're to avoid manipulating this environment. If this beast starved to death in this drying swamp we can't change it."

"Sounds hardhearted," Rogers countered. Then he laughed. "That ol' boy doesn't look much like a saint, that much I will admit. Maybe this is his reckoning." So saying, he swung the copter around and took us off toward some low hills that rose to the north.

I took some holo shots of the puz-

zled carnosaur and promptly forgot him.

He didn't forget us, though.

The hills were covered by a dense growth of conifers. Sometimes there were oaks in the valleys, and a few palms and laurel. There were even a couple of glades filled with viburnum and grape. It was very inviting.

Rogers set us down in a meadow. There was grass all around.

"Upper Cretaceous," James said positively. "The grass proves it."

I opened the door. The breeze was chill. It brought with it the scent of invisible dogwoods and the sough of the pines.

"You're right about this being the Upper Cretaceous," Rogers said suddenly. "There's a hadrosaur."

It was a big one, forty feet long. Hadrosaurs were bipedal vegetarians. Now this one moved its dull gray mass out into the open. It was chewing on a pine bough. The hind limbs were large and muscular, the tail equally so, and flattened like an oar. While we watched, fascinated, it tore down another limb and ran it slowly through the great, broad beak, machining off the needles. Its head was long and low, without the typical hadrosaurian crest. The skin was rather smooth. While the predominant color was gray, the belly was tan. Rogers suggested that it might be mud.

James had been busy with the file.

"It's an Anatosaurus. They had a considerable range throughout the west."

He slung the device over his shoulder and reached for a tranquilizer.

"Let's go out."

"It may not be safe," I said doubtfully.

"You didn't come over a billion miles and seventy million years to hide in a helicopter, did you, Bill?"

He had me there. We left Rogers with the copter to keep it safe, and I took one of the tranquilizers. The behavior of the dinosaurs has always been pretty much of a mystery. Trackways have provided some information, but damned little. I was fairly sure that there was a sizeable instinctual component. They didn't have enough brain for reason, or information storage. Their closest relatives were the birds, and birds are pretty much preprogrammed from egg to individual termination.

I told James to keep behind me and we started out. The grass smelled sweet as we pushed through it. Some clumps were knee-high, with spires of narrow seedcases. There were movements across the meadow as unseen inhabitants of the grassy sea scurried out of our way.

The hadrosaur had watched us dismount with one eye. It maintained a calm attitude until we were fifty feet away. Then it stopped chewing. It didn't take a Lorenz to guess that it was about to do something.

I took James's shoulder and held it. He stopped.

For a long time the only movement was the wind swaying the trees.

Abruptly the dinosaur bolted. We

could hear it crashing through the underbrush for some distance. Then there came a splash and quiet.

"A lake over the next rise," James speculated. "Hadrosaurs were thought to escape carnosaurs by keeping to deep water. That one probably thought we were baby tyrannosaurs."

He gazed about the clearing. The sun was low and beginning to gild the treetops with the ruddy tones of sunset.

"We'd better find a safe place to camp. It's getting late."

I didn't argue the point.

On the way back to the copter, I tripped over something lying embedded in the root-bound soil. It was the femur of a medium sized dinosaur, very long, and delicate, almost like a bird.

James was delighted with my find. He tore up the grass in great clumps and found more bones. We were standing on the site of a disarticulated skeleton. Most of the remains were badly chewed. But the skull was in a good state of preservation. The braincase was broken away, but what remained was high-domed and the eye sockets faced forward. The teeth said that it had been a hunter.

James carried everything worth saving back to the copter in triumph, as though he were bearing the crown jewels of ancient England. He was in his glory. Amid all the manifestations of dinosaurian life he had found some bones. He was the paleontologist's paleontologist. Old habits never die, I guess.

We examined the bones while Rogers looked for a 'safe harbor'.

This time James didn't consult the file. He pronounced the bones as belonging to the genus Stenonychosaurus. This was a small theropod related to the tyrannosaurs, but distantly, who had had ancestors in Central Asia. They had been nocturnal foragers, probably feeding off small mammals. Previously they had been known only from the Oldman formation of Alberta. Remains were rare. But that probably meant that they didn't fossilize well, not that the animals themselves were rare. The bones we had discovered would not have been fossilized. Eventually they would have become one with the soil.

There was a lake beyond the hill. It was broken by several small sandy islands. Rogers selected one near the middle as our camp. The water wasn't too deep for a carnosaur to wade, but I doubted that any would try. That the hadrosaurs felt it was safe was reason enough for me. They should know.

They stayed in the forest long after sundown; we could hear them feeding noisily long into the night while we broke open our own ration packs.

I took the third watch out of choice. The copter carried a radio link and I could use the shuttle relay to interrogate the astronomical computer on board the barge. It was busy mapping the Cretaceous firmament.

Periodically I stomped around the soft sand of the island shore to insure that nothing dangerous was sneaking up on us.

A little before dawn something hooted in the forest. I was busy with a star chart and I didn't take much notice. After a while, though, I abruptly realized that there wasn't a hadrosaur to be heard. They had abandoned their feeding binge.

Gazing across the lake, I saw a number of dim shapes studding the surface like Egyptian statues. The hadrosaurs had joined us in the water.

A chill unrelated to the cool wind blowing out of the north ran up my spine and stopped in the vicinity of my neck.

I fumbled with the big flashlight strapped to my belt and shone it out across the lake. The beam was like a spear of lightning. Everything it touched stood out in stark, silent relief as I moved it along the far shore.

The carnosaur's eyes flashed scarlet as the beam hit him. It was our old, hungry friend from the swamp. He must have been half-dead after traveling all that way in one day, but he was a persistent devil. And he had found himself a young hadrosaur.

He raised his dripping, gore splattered muzzle from his kill. He had to be dazzled by the glare of my light, but it seemed as though he were grinning at me. Then, with the single-mindedness born of hunger, he went back to his feeding. There was a lot of lost time to make up for.

At first light he was still there. Belly full, he squatted on the shore with his hands folded contentedly over his sagging paunch and stared at us like some wise old basilisk. I had seen endocranial casts of his kind, though, and knew that his bliss was one of ignorance, not the wisdom of the ages.

We left him there later in the morning, squatting in the sand with his lake full of fearful hadrosaurs. His larder would be stocked for years to come.

We radioed Jack and continued north, toward Canada. There had been a sizeable dinosaurian population there. James wanted to know why. He was now convinced that we had arrived in the late, or upper Cretacious. All that remained now was to clarify his identification of certain sedimentary units. We might be in the Campanian or Maestrichian. Of the two, the Maestrichian was the latest. At its close the dinosaurs had faded out rather abruptly and the diversification of the mammals had begun. To have arrived at this period in time would have to be an almost outlandish stroke of luck. James figited endlessly, now.

As we flew north the oaks and palms dropped out of the forest complement and the conifers predominated. Only the cycads held on stubbornly. But they appeared stunted.

Jack called at noon. He had brought down a Sauropod. They should have been extinct. Apparently someone had neglected to inform this particular individual. Jack had been forced to tranq the beast. In the examination he had determined that it was definitely warm-blooded, putting to rest an argument that had been bubbling around museum staffs for years. Dino-

BIOLOG

by Jay Kay Klein

● *Would you believe, an Analog author who was raised in the mountains of New Guinea? When Donald MacDonald Kingsbury was one year old, his father, a Yankee mining engineer, was fortunate enough to get a job in the Depression year of 1930 removing the* real *gold from those mountains after prospectors had taken off the top layer. Without roads, the tropical rainforest could only be traversed by planes. Growing up with vintage World War I planes as standard transportation, Don was astounded the first time he saw an automobile.*

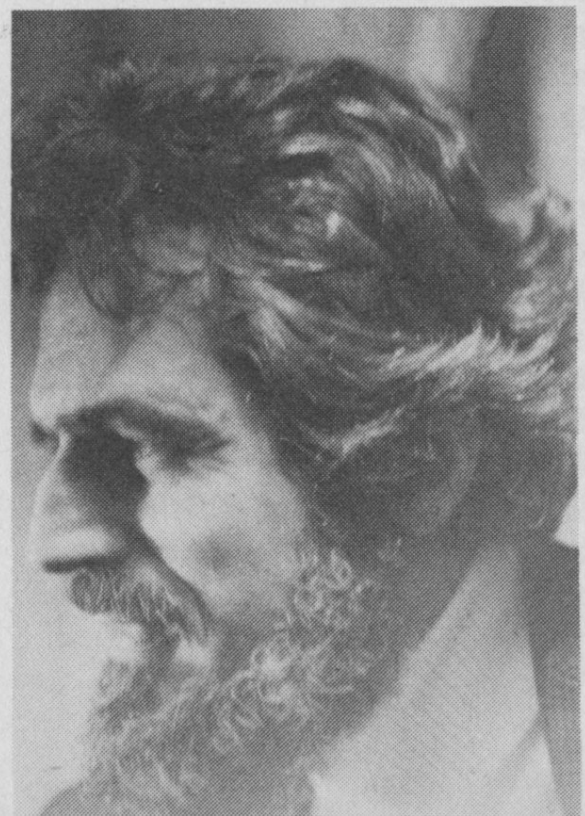
His companions were highly civilized Great War fighter pilots and black people from the Stone Age who would stop whatever they were doing to spend time with a young child who needed help or guidance. Don's first contact with an alien race occurred in a California school at age six when he was beaten up for having an Australian accent.

Later in New Mexico he got to play with someone who was to walk on the Moon years hence, and he remembers losing his first girlfriend when she resented his ignoring her upon seeing snow for the first time. Then it was high school in Hanover, New Hampshire, where there were 150 girls and three thousand Dartmouth men. Discovering science fiction magazines while collecting for waste paper drives, he hoped to impress those girls by being an author. He cried at editor John Campbell's first rejection slip.

Of course, John would never totally reject anyone with a MacDonald to his name, and in due course a first Analog story appeared in the June, 1952, issue. Almost proudly, Don will tell you it received last place rating in the "AnLab." In actuality, there were just four stories that issue, headed by Ted Cogswell's great classic, "The Specter General." Don started off in high company.

While studying mathematics at McGill University in Montreal, Don branched into mainstream fiction writing, but mostly published controversial newspaper articles that attracted the same kind of attention he had received earlier in life with his Australian accent. In the April, 1955, Analog, Don authored the extremely controversial "The Right to Breed." In the following "AnLab," John reported large volumes of mail, unique in 100 percent rejecting the writer's professed viewpoint.

Currently a resident of Montreal, where he is a professor of mathematics at McGill, Don continues to write science fiction stories with his unique outlook. He is a self-proclaimed "space nut," and delights in cooking up personal universes that show man's ingenuity in the face of vastness.



Donald Kingsbury

saurs could no longer be classed as reptiles. Like birds, mammals, and pterosaurs, they were one step more.

Jack identified his prize as being a Tenontosaur. A holdover from the lower Cretaceous. Herbivorous, partially bipedal with a large head, and blind stupid, Jack reported. He had nearly been trampled underfoot as the big beast had blundered away to freedom.

James congratulated his partner, and then signed off as we saw our first horned dinosaurs. The ceratopsians were formed up in a herd, proving that social behavior is not totally dependent on brain size. Once it had been said that the ceratopsians had been too stupid to herd. Now we knew better.

They were on a hillside, cropping grass, bushes, small trees and anything else that got in their way. They were huge, unwieldy eating machines that made goats look picky.

This herd had a couple of attendant carnosaurs.

James decided that they were Gorgosaurs. I didn't argue. I've never been able to see that much difference between old Gorgo and the Tyrant Lizard. Both of them had obscenely big mouths, and enough teeth to make a dentist beam with joy.

The Ceratopsians knew it too.

These were the largest of that breed: Pachyrhinosaurs. They didn't have horns. They weren't impalers. They butted with a giant, ramlike boss sprouting from the top of the skull like a granite boulder. The neck frill was short and capped by two short spines. Hooking with these could still lay open an incautious predator's belly.

Dumb as they were, the adults were formidible beasts. Which was probably why the carnosaurs were careful to keep their distance.

The youngsters kept to the center of the herd. I couldn't decide if this were instinct or just dumb luck. They appeared soft and helpless. The ram was just a bump on their forehead.

Both herd and carnosaurs ignored the helicopter. I requested Rogers to keep his distance, anyway, and started filming. I got lucky.

One of the youngsters decided it was thirsty after a while and broke ranks to scramble toward a small stream that cut through the plain. The adults didn't object. I'm not even sure that they noticed.

The carnosaurs did. The largest made a quick, waddling dash and broke the youngling's back with a snap of his great jaws. It wasn't much of a contest.

The herd ignored the killing. Apparently the adults only got riled by a direct confrontation of the herd itself.

Rogers circled while the carnosaur ate his fill. After he wandered off, Number Two waded in and polished off what remained. All he left was a bit of bony skull.

James speculated that this was why so few juvenile fossils had been discovered. Apparently, carnosaurs made effective garbagemen.

We followed the herd for most of an afternoon, and then turned west to

examine a range of hills that seemed to reach out for the distant coast. Rogers felt it might be a landbridge to the Cordilleran. The fossil record suggested such a thing.

Finally, before dark, we landed in a lush valley nestled in these hills. The next two days were spent in exploration. James and Rogers were impressed at what they found. So much so, that James ordered Jack, over my objections, to fly the shuttle north and join us.

A permanent camp was formed. The copter and shuttle were parked atop a ridge of sandstone that obtruded from the talus strewn slope of a large mesa. Here, the big dinosaurs couldn't reach us, and the smaller ones wouldn't want to. Everyone was happy.

The team split up with everyone concentrating on their own particular field of endeavor. Jack and James seemed to vanish, but I did see Rogers in the morning over breakfast. He was mapping strata that wouldn't exist in our time. I was playing ethologist in the daytime and astronomer by night.

I had found myself a pack of Dromaeosaurs.

Pack was the correct term. They were more properly a pack than the ceratopsians were a herd. They were active hunters, extremely efficient and bloodthirsty. They were also smart. Their brains were at the avian level.

Slightly smaller than a man, they were bipedal runners that preyed on the young hadrosaurs that populated the valley. Sometimes they hunted in concert and dragged down larger prey.

Their method of attack was to run some poor beast into a thicket, corner it, and make the kill with fang and claw. They were well equipped for this. Each of the killers had an enlarged talon on the second toe of the foot. They used it like a large knife, and it was an effective instrument for disembowelment.

I filmed several hunts. Apart from loud and excited hissing, each was carried to its conclusion in a grim silence. My civilized nature was both repelled and fascinated by the stark bloodiness of it all.

On one day while I was trying to record the mating duels of the beasts I came across a solitary spoor crossing one of the main runs that led down to a stream in the lowest part of the valley. There was a dense stand of cycads on each side of the trail at this point. I had thought them to be impassible. Apparently they weren't. The prints in the recently disturbed dust of the trail said that much.

The dry trunks were thick with the remnants of old, withered fronds. A large, fat-bodied spider moved sluggishly out of my way as I rustled about in the litter. The opening proved to be a narrow gap between two dead stumps. Drooping fronds from the other plants had concealed it from casual view.

I squeezed through. Before me was a cleft with low walls of red sandstone. Grape vines grew thickly everywhere. They were tangled on the rock floor,

and streamers crisscrossed the cut. But something passed through here regularly. The trail was dim, but it was there.

The slope of the cleft was upwards, toward the back of the mesa. Eventually, it opened out on a broad shelf that was part of a buttress. The grape vanished, replaced by rank grasses. The buttress had a low cave at its base. A stream ran out of it and spread across the shelf in a shallow pool before spilling off the shelf and down a cliff toward the valley floor. Prints were everywhere. The pale mud was thick with them. A good many led into the cave.

I had left my tranquilizer behind. Just why I don't remember. But now I found myself unarmed.

The prints told me that I was larger and heavier than their owner. So, with nothing else at hand, I picked up a dead and seasoned branch that seemed as though it might be useful as a club and pushed on into the gloomy recess of the cave.

I had no light, so I stepped to one side once I was within to let my vision adjust to the darkness.

It was a large cave. The stream flowed through limestone. There were grotesque formations dangling from the low ceiling, and spikes growing out of the puddled floor. The stream gurgled out of the black depths. But it wasn't the stream that interested me. Almost at once I became aware that I was being watched. Gradually my eyes picked a dim shape out of the shadows.

It was a slim and graceful dinosaur squatting on a sand-covered ledge. By her very attitude I assumed that she was a brooding female, though I couldn't see any eggs, nor even a nest.

She was frightened, but she didn't leave the nest. I was impressed.

Since we had arrived we had been treating the life forms we had encountered as resurrected museum exhibits, not really as living beings even though it was ourselves who were the aliens to this time. Now, abruptly, I realized that here was a being who, like myself, knew and enjoyed life. It takes brains to be frightened, and even more brain to be frightened for something other than one's self.

Dinosaurs didn't have anything to be frightened with. Even the Dromaesaurids, as bright as they were, could not surpass an ostrich, or emu in genius. And most birds were only instinctual machines.

And yet she was frightened.

I stepped back to reassure her, and after a moment she did seem more calm. But she kept a wary eye on me.

It was too dark in the cave to film, and so I began to pick out details of her anatomy so as to preserve them in my memory.

At first glance she was just another Dromaeosaur. Then you noticed that the back of the skull was round, and the eyes faced forward. The jaws were less pronounced. And the hands, already extremely dexterous in the Dromaeosaurs, had an opposing digit in the enlarged little finger. The claws

were reduced. I had to fight down the impression that I was looking at the dinosaurian equivalent of Australopithecines. A dinosaur that intelligent was ridiculous.

But, even so, this was a find. James would be beside himself when I showed him this new genus.

I began backing out of the cave very slowly.

And something hit me from the rear like a bolt of hissing lightning. I felt my jacket being slashed open and spun before that flashing foot could tear into something vital. I fell, and my attacker was forced to come round in front of me. I struck out . . . felt my fist smash into something hard, warm, and scaled, and all at once I was free.

Hastily I struggled to my feet. Before me on the floor of the cave was the mate of my dinosaur. Between us, staining the stream red with its blood, was the headless carcass of a young hadrosaur. Well, I thought, birds bring prey to their nesting females. Why not dinosaurs?

It's easy to give an animal credit for more intelligence than it really has.

The creature was only stunned. Before I could turn and flee it lurched to its feet. And it destroyed all my preconceptions about dinosaurs with one simple action. It picked up the club I had dropped and swung it at my head.

I retreated precipitously from the cave into the sunlight.

The dinosaur followed me, but he stopped in the mouth of the cave.

"I have no intention of harming you, or your mate." My words were soft and intended to calm the creature.

He replied with a loud hiss to show that he was still angry. His was a basic kind of logic. 'You mess with my mate, I break your head.' There's no arguing with that kind of reasoning. My only option was to retreat. If he would let me.

I got lucky. He did.

All the way back to the camp I was lost in thought. It almost got me run over by a thirsty Ankylosaur built like an antique Volkswagen with spines.

I couldn't tell James. He'd never believe me. Jack wouldn't either. Both men were steeped in the accepted dogma of paleontology. Dogma changes, but not swiftly, and not by the quantum leap that this required. Getting either one of them to accept the idea of an intelligent dinosaur would be almost as easy as convincing the Pope that God was dead. Rogers wouldn't be easy either. But I had to share the secret with someone, and Rogers, being a geologist, might have a more open mind about life.

On the following morning, on the pretense of examining a curious outcropping, I brought Rogers along as I returned to the cleft with my holo equipment. We fought our way through the grape vine jungle and up onto the shelf.

I stopped him well away from the cave. I didn't want us attacked.

"Where's this outcropping?" Rogers inquired doubtfully, gazing at the cliff before us.

I didn't answer. I was shining a flashlight beam around the interior of the cave. It was empty. The shelf was bare. No eggs, no club, no bones. They had moved out during the night.

Wisely, I told Rogers nothing. Instead, I showed him a rather ordinary limestone lens in the cliff. He left muttering unkind things about the judgment of laymen.

A week passed. My intelligent Dromaeosaur began to take on the aspect of a dream. I was no longer sure I had really seen it.

I went back to my studies on the taloned killers.

One day while I was filming a hunt, however, something happened that restored by convictions.

One of the runners had split from the pack. Apparently it had detected another spoor. As it paced along a narrow trail through the forest I followed.

A hadrosaur was down. A large one. Another dinosaur was in the process of dismembering it. I knew at once it was the male, even without seeing the crude stone knife it held in one hand.

The Dromaeosaur attacked at once, leaping over the carcass toward the other with a hiss like an open valve on a steam engine.

The knife wielder jumped to one side and stabbed. The stone tool was too blunt to do much more than damage the skin. But the impact knocked the attacker down. Before he could get up I had tranquilized it.

I stayed out of sight behind a tree while the other finished his job of butchering the Dromaeosaur. Between the two carcasses there was far more meat than he or his mate could ever use in a week. And the scavengers were already starting to arrive.

When he left with his spoils, I followed, using binoculars to keep him in sight without being seen myself.

The new nest sight was in a cave a mile down the valley where the cliffs were taller. I made observations until just before nightfall. Then I returned to camp. No one was around. I ate and went to bed.

The next morning I returned to the vicinity of the cave to wait and make observations.

Fascination has many meanings. James would not have characterized these dinosaurs as having very many human virtues. The male, and probably the female when she was off the nest, killed whatever they needed without the slightest remorse. And they were efficient killers. Being unable to work directly with them, I was unable to make an estimate of the male's intelligence. I didn't doubt that, with the exception of us, his kind were the smartest beasts on the planet. But they were rare. A careful search showed no trace of other groups.

I began to feel a certain custodial inclination toward these runners.

By now we knew what time we were in.

James and Jack held a brief meeting. The close of the Maestrichtian is an arbitrary period because the boundary is not a change in sedimentation,

but rather a sudden absence of dinosaurs. By chance, our journey had brought us to this period. This knowledge brought about a change in our attitudes. An age was drawing to an end. We accepted this, but now we tended to view everything with nostalgic eyes. Much speculation was put as to the cause of the approaching extinction.

Jack and James were convinced that it had already been in effect for some time. Winters were getting colder. The midcontinental sea was shrinking into saltflats as the Laramide Uplife continued, forced by the slow compression of Cordilleran America into the West Coast of Cratonic America, impelled by the subducting Pacific plate. As the land rose the climate and environment changed drastically. Warm-blooded though they were, the large dinosaurs were without insulation.

The group drew together almost as though we had begun to need each other's company. In the evenings we sat around a fire listening to the hootings of feeding hadrosaurs while discussing their demise.

Rogers enjoyed putting himself in the role of devil's advocate. He doubted that the dinosaurs would become extinct merely because of climactic changes. The tropics would remain a suitable domain. There was no reason why the dinosaurs already living there would not survive even an ice age. And it was not impossible for them to produce insulation. They had a million years to adapt; hair was merely a modification of reptilian scales. If this happened once, it could happen again. Had not the mastodons and mammoths grown dense mats of hair during the ice ages and lost it once the weather had moderated?

Jack jumped on that. Elephants had rudimentary hair even in our time. And though we ourselves appear naked, we possess the same number of hair follicles as any other primate. The difference lies in the density of the individual hair strand. It had been an easy task for the naked mastodon to sprout a rug. The dinosaur would need much more time. Apparently they had not found it.

"Perhaps they should have invented clothes," Rogers joked lightly.

"That wouldn't have helped either," I said flatly. I had been in a black mood all day. The others hadn't missed it. James glanced at me uncertainly as I tossed a stellar radiation chart across the dinner table. The normal pattern of traces was overwhelmed in one corner by a swollen, cancerous blotch of white.

"That's G0538," I told them. "You can't see anything wrong with the naked eye, but it's gone supernova."

My companions stared upward into the shining, star flecked brightness of the night sky overhead as one.

"We're safe for now," I chided them. "The radiation storm won't get here for another year or so."

"How far away is it?" James wanted to know.

"Eight light-years, closer to Earth than the Centauri system. There's

nothing left of it in our time, only a black dwarf whose hard radiations were discovered by accident during a solar study. The radiation shell vanished into deep space millions of years ago."

Rogers was the first to catch on.

"The radiation front will play hell with the upper atmosphere and climate. I don't like to think of what it will do to the animal life."

"Only the smallest forms will survive," I finished for him. "Turtles, snakes, lizards, crepuscular mammals, fish. Creatures that tend to hide in the ground by day, or night, or are shielded by water. Anything larger than a dog that stays out in the open will find itself fighting cold, and radiation sickness."

"Lord," Jack breathed aloud. "Just like wiping a slate. It's going to be a whole new ball game."

James was more practical than his partner. He had realized another aspect.

"We'd better not be here when the front hits. The radiation shielding in the shuttle wasn't designed for that sort of treatment. The belts around Jupiter are going to flare up like neon tubes when the storm starts sweeping past. When can we close this trip out?"

"I can be finished in a week," I told him.

"Okay. We'll use you as the deadline. The rest of us will wrap up the studies on this valley and get ready to leave."

I've never known a week to go more swiftly.

The mood was grim, like waiting around for an execution. It was impossible to avoid the idea that somehow an entire class of life had been weighed and found wanting.

As Jack has said, the slate was about to be wiped.

But we were too busy to worry. I only had time for one more visit to the cave before we took the shuttle up and began refueling from the barge. I can't say my runners were glad to see me. I was forced to knock them both out before I could get free.

But there was something I knew I had to do. I'm not sentimental in the least, so I don't know what drove me to do it. But there seemed to be a need.

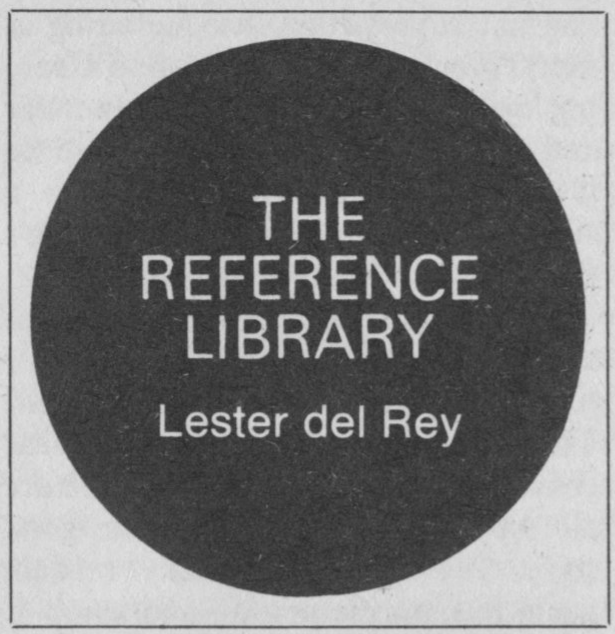
Our last few hours in the Mesozoic were spent staring at the cloud-bloated eye of Jupiter as we spiraled in for the jump home. There's no doubt in my mind that it's the King of the Planets. James went so far as to call it a god, but he's impressionable.

No god would be so puny as to lock itself inside a mere planet.

Rogers says that. And I agree.

Nor would a god deny itself the right to change its mind. I no longer feel our arrival was due to chance.

The eggs should hatch in a day or so. There are five of them. I'm hoping there's a good proportion between males and females. Our runners need a chance. James and Jack have already declared themselves uncles. ■



A TOUCH OF STYLE:

During the years in which I've been doing reviews, I've received quite a few letters from readers—curious or indignant—asking why I rarely discuss the style to be found in the books. So, since this month's offerings in the literature don't seem to impose any pressing demands for reviews, I intend to make an effort to answer that question. That answer won't satisfy anyone, I'm sure from experience; it may infuriate a few, which won't displease me; and it will be longer than most of my dissertations on the craft of reading and writing. So be warned.

Why the subject of style is so fascinating is something that puzzles me, at least when it's applied to a field of literature that is not normally read for its abiding literary value. And if style *is* so important, then I'm surprised that the works of John Collier aren't mentioned more often; I can only consider his style to be a model for anyone writing science fiction or light fantasy; it's always pellucid, frequently brilliant and witty, and never self-indulgent. Yet among the self-deemed style experts, I rarely hear him mentioned.

It's less surprising that would-be writers should be preoccupied with style, however. Partly, that is because written English is something of a foreign language, with an idiom that can only be mastered by practice; hence, most beginners must feel uncertain in their early efforts. However, it shouldn't be the only facet of writing to interest them, as it seems to be.

Whenever I've had to go over their stories with them, during workshops or after lectures, the result is invarying. They listen vaguely as I go into all the real troubles—the ones that perhaps can be overcome; then, at the end, their faces suddenly become reanimated and they ask with a faint quaver: "But what about my *style*?"

An honest retort would usually be: "What style?" But a still more honest one which tact usually forbids my making, even to those who have adequate command of the rules of the language, would be: "Style? It doesn't matter."

That, you see, is my real answer to those who write letters asking my reasons for neglecting the subject. Beyond a certain level of competence that should be found in all published stories, style doesn't really matter for these discussions.

A few readers, to be sure, are bugged on style—or think they are. I suspect in many cases that interest is an acquired one, developed in college or at some writing course; teachers are very fond of stressing style. Why not?

It's the hardest of all writing attributes to lay forth precisely; therefore, no matter what they may say, it's the hardest to refute. And an interest in style is somehow the seeking for the essence—something above the pursuit of the benighted masses. So students learn to read as no writer of stories would ever want to be read: word by word, phrase by phrase, with attention on *how* rather than *to what end*.

Maybe we need some Kant to write a new second statement of his categorical imperative, this time about literature rather than ethics. "So read as to treat literature, whether in thine own devising or in that of any other, in every case as an end withal, never as a means only."

Anyhow, as a rule the readers who read for style don't buy many books. And those who really love the finest example of style will usually be seeking good copies of essays written a century or more ago—the one type of literature meant to be savored and lingered upon. Most readers read for story, not for style. Why not? That, after all, is what fiction is all about—story. Hence, a man who can write a good story will sell his books, even though his style is but minimally adequate (or totally unacceptable to those who have lost the art of reading story instead of sentences).

It's the job of the editor to bring out books that readers want. Ideally, he should bring out the best ones he can find that will be popular, naturally; if he's a good editor, he'll try to persuade the writer to work to make them the best that the writer can do. But it isn't his job to educate the public (though, I'll admit, I wish some would stop trying to miseducate the public with flagrant superstition masquerading as fact). Nor is it his job, beyond cleaning up obvious lapses from grammar and sense, to rewrite the stories, even if he should be brilliant enough a stylist to do so to another man's concept.

Neither is it the proper function of a reviewer to judge what every reader tends to judge differently for himself. There are areas of agreement on what constitutes good story value. There are almost none on what constitutes good style. I've heard too many readers gush over purple prose—and some of the style-smellers did so, also—to bother pointing out the obvious any longer. I've seen too many stories with barely adequate stylistic treatment nominated for Hugos. And, damn it, I've enjoyed too many of those stories myself, though I'll probably never reread them. As a reviewer, my job ideally is to help the reader find what may interest him and avoid some obvious disappointments. I leave style, along with other less easily determined matters, to the critics; they write for an audience who may be interested in such matters. I assume I write for an audience—and one as entitled to its opinion as any other audience—who enjoy reading stories and are willing to buy them.

Just what is style, anyhow? Webster's 2nd Unabridged gives a lovely answer, among others: "the quality which gives distinctive excellence to artistic expression, consisting especially in the *appropriateness and choiceness of relation between subject, medium and form*, and individualized by the temperamental characteristics of the artist." Ah, I wish I knew who wrote that! Beautiful. That itself has

style—and in a dictionary!

And there's the gist of it—appropriateness of relation between subject, medium, and form.

Can anyone really believe that it is appropriate to write a science fiction story about conquering the planets the way Kafka approached *The Trial*? Or in the "experimental" prose that was being used back in 1930 in Whit Burnett's *avant garde* magazine—and is still considered daring by some? Or even as Dashiell Hammett deemed appropriate for *Red Harvest*—perhaps some of the finest pulp style ever written? Since the days when the dicta of style were laid down by certain pundits, the subject, the medium, and to some extent, the form, have changed for science fiction.

Style is a lot more subtle than most who discuss it seem to think. It's the soul of writing, perhaps—and shaped by the body it wears, by the experiences within that body, by the world against which it must impact—and when dissected, I think it dies.

Of course, there are the easy signs by which those who treat it mechanically can feel they have detected bad style. Count the adverbs—or the adjectives; if there are too many (how many? Who knows?), the style is bad! And that's piffle. That's on a par with *Strunk on Style*—which may be the worst book on the subject ever written, and an excellent example of lack of style itself. Look to see whether the writer has "used the said book"—that is, avoided the simple word "said" for other expressions at every opportunity. (Jim Blish contributed this bit of myth to the field. It's valid when and only when the writer is making a

annual ANALYTICAL LABORATORY results

Final tabulation of the Annual AnLab votes ended just as this edition went to press. Here are the winners. More information about the voting will be in next month's issue.

Serials

1. AFTER THE FESTIVAL, George R. R. Martin
2. THE WONDERFUL SECRET, Keith Laumer
3. OF FUTURE FEARS, Mack Reynolds

Novelets

1. "Stardance," Spider and Jeanne Robinson
2. "Ender's Game," Orson Scott Card
3. "Pinocchio," Stanley Schmidt
4. "Stepson to Creation," Jack Williamson
5. "Beachead," Dean McLaughlin

Short Stories

1. "A Time to Live," Joe Haldeman
   "A Rain of Pebbles," Stephen Leigh (tie)
2. "Lord of All It Surveys," Alison Tellure
3. "Dog Day Evening," Spider Robinson
4. "Skysinger," Alison Tellure
5. "Lauralyn," Randall Garrett
   "The Screwfly Solution," Raccoona Sheldon (tie)

labored effort to avoid the simple way deliberately; when it's done naturally, nobody notices. And Jim, unlike too many others, meant it to apply only when it should.)

Where does one find great style? The Russian writers? The French? Hesse, Kafka, Mann? Not by a long ways—unless you have read them in the original. Hermann Hesse, as a stylist, was one of the most brilliant produced in the German language. It is a never-failing delight to read his prose, even when the immaturity of his themes obtrudes—in German. But the translator into English, while preserving the meaning and much of the feeling, simply was not an English-writing Hesse. His style is gone. So is that of Thomas Mann—though there, perhaps, the translation may even be better. I can't say about the Russians—I never learned to read that language. But in the case of the others, most certainly the English versions do not have the same style as the original. Is great style to be found in Shakespeare? I think so—at least in most of his tragedies and historical works about England. But would you want to try using that as a model for story telling today? Ecclesiastes? Magnificent—but essentially, that's an essay, not a story—and essays are the natural place for style to flourish outwardly; it's a shame so few have the talent to create or appreciate that form today.

Where do you find really horrible style? Well, all right, some are going to mention E. E. Smith's *Skylark*. Maybe. Maybe not, aside from the pleasure those stories brought—and still bring—to a lot of young readers. I can't read it myself today. But did you ever try to rewrite it into what would pass as satisfactory form today? I did once, out of curiosity. The result was that whatever power the story possessed died completely. Without that adjectivated, hyperserious and clumsy style, those stories simply won't work as they were meant to. Somehow, it passed the test of appropriateness, at least when it was published.

Bad style, of course, is whatever destroys the affinity between reader and story. Sloppy grammar, misuse of words, affectation (as the use of present tense where no immediacy is implied, purposeless bathos, "archaic" or "quaint" forms where they don't belong), and lack of clarity all destroy style—and story. And while symbols have their place and metaphor is necessary to language, the conscious chasing after them as an end is usually fatal to success.

Good style is harder to analyze. Ideally, it should have elegance, wit, strength, vigor, vividness, and clarity—each in its proper time and place. Fine. Now define those and show how they are achieved.

And, despite what may be taught in courses where everything must be simplified to be conveyed at all, style is not *the* most important element of literature—even of so-called great literature. (Even the essay must stand or fall on thought and attitude.) Style is only one of many elements that go to make up good fiction. Story, vision, insight, background, color, emotional depth, philosophical outlook of the narrative, pacing, organization, consistency; and perhaps above other desiderata is the creation of characters that have spirit as well as body.

Lately, there seems often to be another factor to be sought by some

readers, but I don't accept it. This is suitability or conformity to the prevailing fashion or mode. Far too often, that seems to underlie what those who write me are calling style. But the dictionary refers to this as "stylishness." And to me, that is as much the antithesis of style as artiness is of art.

In any event, it seems to me that style is almost as personal a matter to readers as it must be to those writers capable of achieving it, in greater or lesser degree. I shall continue to ignore it in most cases, except that those books that offend me in their writing usually do not get read by me—and hence are weeded out automatically. Beyond the level necessary for enjoyment of a story, style really doesn't matter to my reviews, as I see it. It's a subject for the critics. And for those interested, I can only recommend that they turn to those learned critics in the fan magazines who are happy to inform on all matters of literary style.

Style does enter into my reaction to one recent book, however. This came about because a letter that accompanied the book indicated that an editor felt the writer wrote with much of the style and quality of Ursula Le Guin. I found that a little surprising, since I'd detected no such similarity in previous books, although some of the writing had been quite good.

The book is **Companions of the Road** by Tanith Lee (St. Martin's Press, 222 pages, $8.95). It consists of two stories, each a long novelette. The first has the same title as the book, and the second is entitled "The Winter Players."

The first, laid in some medieval world, concerns Havor and two companions, who take a chalice from the burned castle of a king, after the sack of a city. The king, his wife, and his daughter are reputed to have had dark powers and to have used the chalice for grim rituals before they died. The tale follows as the looters flee, pursued by the three dead. It's well told, the handling is interesting—but it's still a rather routine fantasy; and the ending runs dangerously close to having the cavalry rush over the hill—or maybe out of the grave. Nothing like Le Guin there, most certainly.

But in "The Winter Players," I began to understand. This is the story of Oaive, a village priestess. A relic is taken from her shrine by Grey, a strange and tantalizing visitor, and she must follow to recover it. Grey interposes obstacles which she must overcome by magic—yet when she fails, Grey saves her; and still he forces her to pursue.

Here—yes, definitely, I can see how it might remind one of Le Guin's *Tombs of Atuan.* (Deliberately? I don't know.) The style is not the same; but the attitude conveyed in the writing is. And very good.

Then, damn it, the fascinating and challenging Grey becomes altered to a rather stupid patsy. And Oaive gets involved in time. So does Lee—and gets involved in paradoxes that never do get straightened out to anyone who tries to think through what the story gives us as an ending. Do what you will, it won't work that way.

Minor Tanith Lee. I don't consider it worth buying.

The Adolescence of P-1 by Thomas J. Ryan (MacMillan, 280 pp., $8.95 cloth, $4.95 Collier paperback) is another matter. Very briefly, this is the story of Gregory, who devised a pro-

gram to trick a computer—and succeeded so well that he created a sentience that spread through all the great computers, to invade the Pentagon, raise general hell, and get Gregory into a total mess.

Okay, so the idea of a computer (complex) coming to life is not exactly new? It is when Ryan does it. Ryan is himself a computer troubleshooter, and while I'm not sure of his economics in some ways, I must admit the computer evolution is outstandingly good.

Unfortunately, Ryan also periodically gets cute with his people. Chapter II almost turned me off, and there are other bits that should have been totally excised from the story. But when the computer being, P-1, comes looking for Gregory, things go very well—until toward the end. There, damn it, P-1 switches character from himself to golem, junior grade; he violates everything about his previous behavior in an expanding explosion of stupidity. It simply doesn't make sense. And while the epilogue does much to save it, nothing can repair all the damage done to the story.

This is either the best bad book or the worst good book I've read for some time. It's thoroughly aggravating, because it could have been so good throughout. Well, this is Ryan's first book; but didn't he have an editor?

Still, there's so much worth reading that I must recommend it.

And to anyone who has a bit of love in his heart for the Wee Ones and a taste for good whimsy, I must recommend **Gnomes** by Wil Huygen, illustrated by Rien Poortvliet (Harry N. Abrams, $17.50). It came out in Dutch originally (now nicely translated) and I enjoyed it so much I read most of it then, though Dutch isn't one of my better languages. It would make someone a lovely Xmas present any time of the year. Look at it a couple of minutes and you'll know whether you have to have it or not.

It is, as anyone examining it should clearly see, the true accounts of the Little People as finally revealed, complete with drawings of their tools, homes, artifacts, and all matters pertaining to them. It gives their history as they remember it, their legends, and a wealth of periological detail for those anthropologically inclined. There is even a pair of maps to guide those whose efforts in locating the surviving Folk have previously been frustrated. Delightful.

Finally, my thanks and apologies to those who pointed out that Velikovsky's *Worlds in Collision* had previously already appeared twice in paperback. I missed those appearances and had to depend on my original hardbound copy. But to those who insist that the problem of angular momentum can be dismissed because the strange orbits of the planets in the theory have all been explained, I can't accept your argument. You see, when Joshua was around, the world—the whole Earth—stopped rotating, right? (Forget about starting it again.) What do you think was involved in the sudden change from rotation to nonrotation? Torque conversion? *That* is angular momentum—and it better have been conserved, unless you can prove to me that the crust of the planet melted and we're all dead! Better go back to Carl Sagan's article again—or any good book on physics. ■

BRASS TACKS

Dear Mr. Bova:

In view of your response to John R. Isaac (page 175 of the October issue) it appears I should have enlightened some SF people on education and taxation instead of economics last year.

When you propose that teacher salaries be based "on the percentage of the teacher's students who pass (an external) test" you indulge in an error of truly galactic proportions, for you assume that either all students come to their classes with equal abilities and preparations, or that the teacher can easily do something about equalizing any differences. The truth is of course very complex. Would you really pay Teacher A less than Teacher B, when Teacher A is assigned a class of children who come from a culturally different area, or had a poor teacher the year before, or inherently score lower on whatever measure of ability you use, or have other problems—while Teacher B gets "the good kids," the ones from homes with well-educated and aware parents, lots of learning opportunities, majority culture, excellent teachers before, etc.?

Of course teachers differ in how well they do their jobs, and those who are below par ought to be dropped or improved. But it is wildly unrealistic to think you can discover the poor teachers by testing their students!

You also say "The ultimate social test of the teacher's success, of course, is the amount of tax money that the teacher's students pay to their various governments." I am aghast that you might actually believe this. What if a given school turns out graduates who go mostly into occupations and professions which offer little opportunity for getting rich: clergy, teaching, nursing, etc.? And if a school in the next town, possibly due to family background, turns out a lot of graduates who go on to head GM, or IBM, etc.? Is any of this the result of the teacher? And which teacher? Possibly the teachers whose pupils go into the clergy or teaching would be considered better teachers, by many, than those whose students wind up in corporate leadership.

And it has long since been proven (see California and New Jersey Supreme Court rulings, for example) that the tax resources of a community have nothing to do with the abilities of the citizens—taxes paid depend much more on where industry chooses to locate, and that is based on natural advantages, attitude of the elected leaders toward subsidy, etc.—not on the education the residents once received in school. . . .

In one short paragraph, Mr. Bova, you have spouted more sheer nonsense about education than I can satisfactorily respond to in many pages . . .

Idiocy, sir, pure and simple.

RINEHART S. POTTS

The plaintive wails of the teaching profession make it sound as if nothing can (or should?) be done to improve the decaying state of American public education. This is as dangerous an assumption as the idea that

students should be promoted whether or not they have learned how to read and write.

You can *discover poor teachers by testing their students—although obviously the tests should reflect the students' differing starting conditions. And as for using taxes as a measure of a citizen's contribution to his community—what better method do you suggest? Again, the testing of the* teacher's *ability can be keyed to the norms for that kind of community. Pollsters do this all the time.*

Teachers should not be shocked at suggestions for measuring their effectiveness. They should welcome such measures as an opportunity to get rid of the deadwood that's cluttering up their profession. Of course, if they're afraid that they themselves are part of the deadwood . . .

Dear Mr. Bova:

In spite of What We Learned In The Yom Kippur War, tanks will be around for a while yet. Studies of the fighting indicated that the missile weapons made a rough deal of things, but that when coordinated tank-infantry forces were in action, the infantry combed out the missile shooters and bazooka crews fairly well. Many tanks struck with shaped charge weapons were back in service in short order.

The conclusion struck by the US Army was that the tank gun using hypershot AP is THE killer, since a solid hit on a tank with an HVAP usually put it out of service, useful only as scrap. The US/UK 105MM HVAP at a muzzle velocity of above 4500 was less dangerous on paper than the Soviet 115mm steel dart from a smoothbore tube. The HVAP/FS/DS round is also made by the US and others, and a recent version we make for the 105mm gun, using depleted uranium penetrators is said to be very effective on armor. The Soviet round, by the way, fires its steel dart with discarding sabot at 5200 fps and it is stabilized by fins on the shot itself.

The Israelis took it on the chin at first. Some of this was due to following our advice, reputedly, since we usually take it on the chin ourselves, until we find how to return the compliment. They were foxed by the Arabic states for a while, but adjusted (their strongest point) and rolled back. By using hull defilade, tanks avoided being hit with light man-pack missiles, and by using their machine guns liberally, they harassed the guys with the RPG7 launchers. One tank was said to have the control wires of 11 missiles draped over its turret. Since a tank main gun can fire a shot or shell nearly a mile in 2 seconds, a missile crew may have a round well in flight and still die before the hit is made, if one of those tanks hits them. The missile may have a dead hand on the stick by then. It is hard to make a 400 mph missile fly faster than a 4800 fps shot.

England has developed a new composite armor which resists all current types of armor busting rounds. It is said that a few ounces have been snuck to the USSR, but if I read the story aright, they'd have to have a plug of armor the full thickness of the plate . . . Surface or back plate would tell little without the filling between.

I read quite a few tales back in 1940 about the uselessness of the foot soldat and the dogface still walks to work at some stage of the game. Lasers may

make it hard, but some poor oaf will be out there with an individual weapon, even so.

JOHN P. CONLON

52 Columbia Street
Newark, OH 43055

But the thrust of modern weaponry is making the tank harder and harder to support. And the aircraft carrier?

Dear Ben:

Richard Rosa's "Experimentalism" (December issue) made a lot of sense! My congratulations on choosing Rosa as guest editorialist—let's hear more from him.

I am not writing to argue with his excellent thesis. On the contrary: perhaps I can offer a couple of thoughts that will further illuminate what he said . . .

We Americans have an unfortunate tendency to "end-run" big problems. That is: when we have complex difficulties (e.g., cancer, drug abuse, health care, poverty or malnutrition), we are likely to set up a Czar or a Board to deal with them—directly and immediately. Never mind about side effects.

Or we pass legislation saying, in effect, "This evil thing will henceforth be illegal." Of course, that approach usually works about as well as Prohibition did.

The other thing is that any enacted law seems to have a built-in diode. It is easy to pass laws, much less easy to get rid of them. (Perhaps those so-called "Sunset Laws" should be applied more widely.) Worse yet, the politicians' psychology seems to go, "Well, that didn't do the job; obviously we didn't make the medicine strong enough, so let's apply more of

the same." And then they wonder why matters go from bad to worse, while regulations and bureaucracies multiply.

So—what am I getting at? Simply this: that the scientific method could not have succeeded if every scientist had been obliged to keep at one chosen experiment all his life. He had to be able to say, "Sorry, blind alley; let's try something else."

And so it should be with Government. As with science, nothing should be cast in concrete. It should be at least as easy to repeal a law as to enact it. That isn't going to happen tomorrow—after all, politicians love power—but it must happen if we are ever to become an experimentalist society.

CHARLES H. CHANDLER
27-D Hampshire Drive
Nashua, NH 03060

The underlying problem is that almost all of society's institutions—such as the law, religion, economic and political systems—are aimed at preserving the status quo. *They are past-oriented, backward-looking. Science, by its very nature, is anti-*status quo, *future-oriented, forward-looking. No wonder politicians are instinctively antagonistic toward science!*

Dear Bova,

I was extremely disappointed by Lester del Rey's review of *The Ophiuchi Hotline* by John Varley. Granted that the novel does not top the consistently high quality of Varley's shorter work, I feel it displayed an imagination, a knowledge of scientific fact and a fictive skill which easily place it above most of the SF novels we see these days, and above most authors' first attempts at the novel form. If

Varley failed in *The Ophiuchi Hotline* it was a failure to shut off his inventiveness. The storyline became so fascinatingly complex that he was clearly hard put to draw all the strands together to a completely satisfying conclusion. Del Rey barely gives credit to the garden of John Varley's mind, instead offering criticism that was both clumsy and ill-aimed.

For one example, del Rey describes "frame" stories as out of vogue. Writers of merit use whatever tools are required to properly evoke their worlds, with little regard to literary fashion as delineated by superficial critics. But Varley's novel is not a frame story in the first place. Some of its intersticial passages are in the form of documents produced by characters in Varley's world, but this in itself does not constitute a frame. Others of del Rey's notions of ideal science fiction and their relevance to Varley's book are equally spurious.

As one concerned with both writing and the critical process, I wish del Rey had sharpened his pen and opened his mind before reviewing *The Ophiuchi Hotline*. . . .

PAUL NOVITSKI

1152 Hodson Lane
Eugene, OR 97404

Book reviewers are not supposed to be umpires, except that they do tend to "call 'em as they see 'em."

Dear Ben:

Ernest Blake, in your October issue, asked if there is an Energy Alternatives Clearinghouse.

The answer is yes! It's called *Synergy: A Directory of Energy Alternatives.* It is an excellent bibliographic source of materials on all aspects of energy (alternatives) and so on.

Write to:

Synergy: A Directory of Energy Alternatives
Box 4790
Grand Central Station
New York, N.Y. 10017

BARBARA WENTZEL

College Park, MD

Dear Mr. Bova:

Re: "Home Computers Now!" in the November Analog. I may sound like a spoilsport, but is there any real use for a home computer? All the activities on page 62 can be duplicated by an alarm clock or clock radio, a desk calendar, a game board or two for the children, a typewriter (unless an article manuscript needs to be right-justified) and a telephone for the correct time. Except for calculating L-5 colony configurations, which is not a daily occupation of the homeowner, a home computer is totally unnecessary.

Think of the electrical energy to be wasted on this expensive plaything. Face it—the so-called usefulness is just an excuse for the hobby. The home computer is the model railroad of the future—nothing more.

DONALD FRANSON

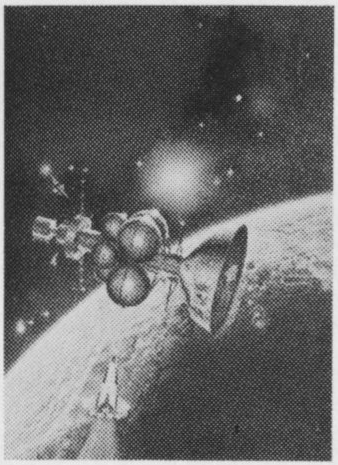
6543 Babcock Ave.
No. Hollywood, CA
91606

All right computer enthusiasts, you've been challenged! What uses for home computers are there? My own hope is that books and magazines can eventually be sent directly from a publisher's office to a reader's home electronically, using a telephone-computer-video recording system. Any other ideas?

JANUARY 1976

JUNE 1976

JULY 1976



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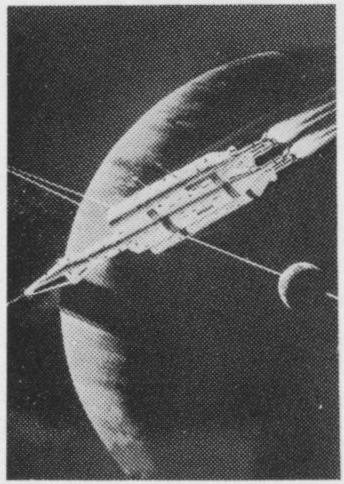

OCTOBER 1976

READ IT SLOWLY.

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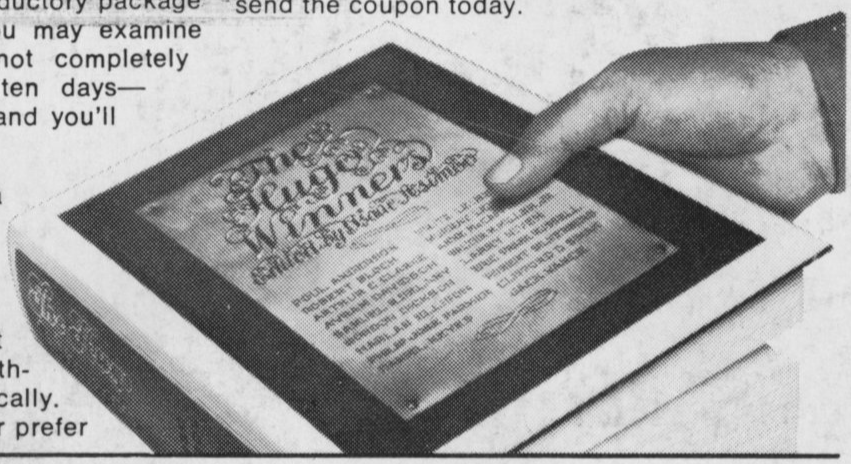

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