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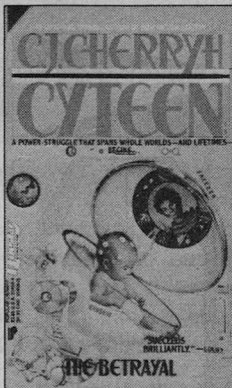
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**A WORD FROM
Brian Thomsen**



CYTEEN by Carolyn Cherryh definitely falls into the category of science fiction epic. While it provides perspective on the Merchanter universe, its political/mystery plot fully illustrates the major theme of "nature versus nurture," or more simply, what makes an individual an individual.

CYTEEN is also an epic in size (over 330,000 words long). Though published in hardcover last year in a single volume, we have decided to break it into three parts for its paperback edition with the following subtitles: The Betrayal, The Rebirth and The Vindication.

Rather than the higher-priced trade paperback form used for many long books such as *The Mists of Avalon*, *CYTEEN* will be available in three popularly priced mass market books released once a month for three consecutive months. Each volume is as long as an average SF paperback, and by the end of April, all three *CYTEEN* volumes can proudly take their place on your bookshelf next to the other C.J. Cherryh classics.

Instead of the usual question, I'd like to offer a suggestion. For Valentine's Day, give a Questar book to someone you love.

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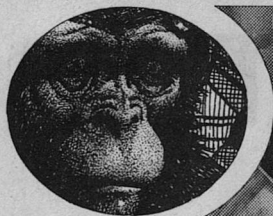
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102



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78

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Novelettes

NOTHING IN THE NIGHT-TIME, Harry Turtledove	10
ON THE WINGS OF A BUTTERFLY, Michael F. Flynn	50
HUMANITY TEST, Charles Sheffield	102
THE SYLPH, Rick Shelley	138

Science Fact

MARS: THE SOVIET MARCH, Donald F. Robertson	33
---	----

State of the Art

OVER-COMMUNICATED, Ben Bova and G. Harry Stine	98
--	----

Short Stories

SUNDANCER FALLING, Geoffrey A. Landis	78
EXTINCTION THEORY, Jeff Hecht	91
THE MUSKETEER MENACE, Laurence M. Janifer	125
ORIGINS, Harry Frank	173

Reader's Departments

THE EDITOR'S PAGE	4
IN TIMES TO COME	32
FUTURES, Matthew J. Costello	77
THE ALTERNATE VIEW, G. Harry Stine	134
BIOLOG, Jay Kay Klein	172
THE REFERENCE LIBRARY, Tom Easton	177
BRASS TACKS	186
THE ANALOG CALENDAR OF UPCOMING EVENTS	192

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OPEN LETTER TO A TEACHER

Stanley Schmidt

Dear _____:
This probably isn't for you, since you wouldn't do anything like what I'm going to describe. But please read it anyway. Even if you don't see yourself here, maybe you'll recognize a colleague—and maybe you can get him or her to take a fresh look at what he or she is doing. Some people, after all, do things with the best intentions that they wouldn't do if they'd thought through the consequences.

What prompts me to write is a couple of letters I've received in the last few months. One was a cover letter for a story submitted by a high school student (let's call her Anna, though that name is fictitious) who said she'd started it some time ago, put it aside, and finally

finished it when the teacher of a creative writing course she was taking assigned "a story," without further specification of theme or content. Anna had not previously found much of interest in this course—all previous assignments had been on quite specific subjects, none of which struck a chord with her—and therefore had not put much effort into it or impressed the teacher. Given the chance to pick something that did interest her, she returned to this story, which was something she had created and cared about. Because she cared about it, she *worked* on it, and produced something far superior to her previous assignments. The relatives and friends she showed it to liked it so much they suggested she try to sell it. Admittedly, friends and relatives are notorious for

their lack of objectivity as critics, but in this case even Anna's teacher was impressed—so much so that he accused her of plagiarism. He proceeded to cross-examine her every way he could think of, determined to get her to “confess” or, failing that, to betray her ignorance of something that went into her story.

Now, bear in mind that the only evidence Anna's teacher had that her work was plagiarized was that it was conspicuously better than what he had seen from her in the past. Then consider an outlandish hypothesis: that the true story behind the story happened exactly the way she told it—that it was better because it was the first one she'd written that she cared enough about to try to make it special. It's very evident that she succeeded—and her reward, instead of praise for a job well done, was what she must have seen as vicious, ungrounded accusations from the person she had most hoped would give her that praise!

You're a teacher; you *must* know about positive and negative reinforcement. What you may not remember is the full extent of the power you hold over students, because of the special regard they have for your knowledge and position (even though most of them would never admit it). What happened to Anna suggests that she may have both a real attraction to writing and a real aptitude for it—both of which may have been irreparably damaged by a few thoughtlessly chosen words from a teacher who should have been excited

that he had finally found a way to stimulate her interest.

Now I know it has been said that any writer who *can* be discouraged, *should* be. There's even some truth in that, because writing is a very unpredictable business which can include long, discouraging periods, and a would-be writer who is psychologically unable to weather those would be better off in another occupation. But is it really necessary to try that hard to discourage them that early? Many students are still in a stage where they need to be convinced that they *can* do something well, not that they *can't*. And as a teacher with quite a few years' experience myself, I found that, given suitable guidance and encouragement, most such people can do quite a bit more than they think they can.

As a teacher who cares about bringing out the best in all your students, you've probably found that, too. As one who cares about developing their integrity as well as their academic skills, you naturally want to be alert for plagiarism, since it does happen occasionally. But I trust you remember also that there are other possible explanations for quality, and that one of the key values of this civilization is that people are innocent until proved guilty. I trust that you would not therefore tell Anna as a statement of fact that she was guilty of a serious offense unless you had genuine evidence that she was.

You may be thinking that I'm betraying my own gullibility by believing too readily that Anna was telling the truth in her cover letter, and that real

teachers would not make such a bald accusation without strong supporting evidence. I would like to believe that myself, but the other letter I mentioned won't let me. It came from another part of the country and as far as I know there was no connection between the two, but it described a very similar situation — from the other side of the desk. This one came from a *teacher* who had received a story that was better than he was used to from a certain student, and therefore suspected plagiarism. Only

“suspected” (which might have been reasonable) is far too weak a word. The language that this teacher used in his letter to me left no room for doubt about the student's guilt or innocence. Why was the teacher writing to me? Because he had been frustrated in his efforts to get the student to confess, or to track down the published original from which the student's story had allegedly been copied. Since the story was science fiction and I am a science fiction editor, he thought that I might recognize it and

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remember the copied prototype. My answer was that I recognized nothing in the story except a few stock background elements that virtually all science fiction writers take for granted, the story as executed was not of publishable quality but might show potential in a young writer—and I hoped the teacher could find it in himself to offer the student an apology for what seemed to be an honest but potentially destructive mistake.

In neither case did I see any evidence of plagiarism, yet in each the teacher was adamant in his accusations based on no more than a hunch. What I find most astonishing in their behavior is their apparent inability or unwillingness to recognize that students can change, sometimes dramatically—even though that is exactly what the teachers are supposed to be trying to help them do! As a good teacher you have probably observed that the same techniques do not work for all students, either for motivating or for getting points across. Teaching is an awfully important part of keeping our civilization alive and growing into the future, and an important part of teaching is learning what works for each student. It seems to me that when a teacher who has been failing to achieve much with a particular student suddenly sees evidence that something has clicked, his job (in the absence of any *real* evidence for plagiarism, of course) is to figure out *why* something finally clicked—so he can help make it happen again. It is *not* to sneer, “No, this can’t be yours, because it’s good.” That is not education—it’s contra-education.

Personally, I find Anna’s claim that

her “plagiarized” story was her first good one because it was the first assignment that interested her eminently believable. As both a student and a teacher, I’ve seen that happen repeatedly. Some teachers may wish that all students were so interested in their subject that they needed no coaxing, cajoling, showmanship, or trickery to get them to work at it. But you and I know that the real population isn’t built that way. *Some* students motivate themselves quite nicely, but an important part of your job is to find some way to jump-start the ones who don’t.

And if you can, that’s part of your pay. I recall a student of mine who had a fourteen-year record of being considered a poor student and a discipline problem. Before he ever entered my class, colleagues warned me I couldn’t expect much of him. But that year he did truly outstanding work in two difficult physics courses taught by two professors—and it was very clear and verifiable that the work was his own. Later—a goodly while after those courses had become history—I asked him how he accounted for the odd discrepancy between his past record and his performance in those courses. He shrugged modestly and said, “I never had a teacher who made me feel like working before. Here, I found two.”

I’m convinced he was telling it exactly as it was—and it was one of the most rewarding things that ever happened to either of us. If it’s never happened to you, I do hope you’ll try for it.

It’s worth it. ■

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NOTHING IN THE NIGHT- TIME

Harry Turtledove

There are two main ways
to leave a mark in
the world you live in.
One, of course, is
by doing things
to it. The other . . .



The tall fur crest above Gazar's eyes rippled slightly. With Atheters, Jennifer Logan thought, that was supposed to mean they were going to get down to serious business. She hoped so. Gazar had shown her nothing but junk—well, not junk, but certainly nothing worth taking offworld—for the past two hours.

As the Atheter merchant rummaged through his wicker basket, Jennifer wondered, for far from the first time, what she was doing sitting cross-legged on a fat tree branch dickering with an alien who looked like a blue plush chimpanzee with a prehensile tail. She'd firmly intended to teach Middle English literature after a single trading run gave her a taste of the life Middle English science fiction writers tried to imagine.

That had been two trips ago, now. She still hadn't quite worked out why she'd signed up for her second trip. Had she really been *that* depressed about not getting the first job she'd applied for?

She stopped the useless worrying as Gazar's big golden eyes—his least chimp-like feature—went wide. He'd found what he was looking for, then. With a fine dramatic sense, he held whatever it was concealed between his six-fingered hands. He started squawking. The translator Jennifer wore on her belt turned his words into Spanglish: "Here, my fellow trader, is something not many will be able to show you."

"Let me see—" Jennifer's soft, breathy voice didn't activate the translator. She tried again, louder: "Let me see it, please." The machine let out a series of raucous squawks and shrieks.

"Here." Crest erect with pride, Gazar opened his hands. "This is carved

omphoth ivory, which of course means it is very, very old."

"Why 'of course'?" Had Gazar not made an issue of it, Jennifer would have taken him at his word. The ivory of the figurine was yellowed, the carving in a style unlike anything she had seen on Athet: it was vigorous, exuberant, unsophisticated but highly skilled. Back in civilization, collectors would pay a lot for it.

"Surely any nestling knows—" Gazar began. Then he let out a high-pitched screech that reminded Jennifer of forks on frying pans. To him, it was laughing. He was, in fact, laughing at himself. "But why should you, from the treeless wastes between the stars? 'Of course' because as soon as my earliest ancestors bravely crossed the Empty Lands into this forest, they began to hunt the *omphoth* that roamed here. No *omphoth* has been seen alive in more than a thousand winters."

"Oh." Jennifer was glad the alien would not notice her distaste. Terrans, she was sure, had exterminated a lot more species than the Atheters, but they had also learned not to sound proud of it. Maybe, she thought, Gazar had an excuse. "Were these *omphoth* fierce animals, then, that killed and ate your people?"

"They were worse!" Gazar's tail writhed like a fat pink worm, a sure sign of agitation. "They ate the trees! Fruit, leaves, branches, everything!"

That hit him where he lived, all right, Jennifer thought, in the most literal sense of the word. Atheters were arboreal by evolution and by choice. They only came down from their precious trees for stones and for copper and tin

ores. Their domestic animals were as treebound as they were. No wonder they called the savannahs that alternated with their rain forests "the Empty Lands."

"No wonder you hunted them, then," Jennifer said soothingly. "What would you want in exchange for this figurine?"

"Ah, so here at last is something that interests you, then? I was beginning to think nothing did." Atheters understood sarcasm just fine. Gazar's tail twitched again, a different motion from the one it had made before: he was deciding how greedy he could be. "You must understand, of course, that because there are no more *omphoth*, the object is irreplaceable, and so doubly precious."

"I suppose so," Jennifer said. The flat tones of the translator made sure she sounded indifferent. She'd hoped Gazar wouldn't think of that.

"Oh, indeed!" Always raucous, his screeches were nearly apoplectic now. "In fact, I would not think of parting with it for less than half a dozen scalpels, two dozen *Swissarmyknives*"—the Terran name came out in one squawked burst—"and, let me see, two, no, three bottles of the sweet tangleter you humans brew."

He meant Amaretto, Jennifer knew. The Atheters were crazy about it. She also knew he had decided to be very greedy indeed. She gasped. The translator turned the noise into a scream of rage worthy of—what was that ancient mythical ape's name?—King Kong, that was it. That was how Atheters gasped. They were a noisy species. Jennifer said, "Why not ask for our ship, while you are at it?"

Gazar's grin exposed formidable teeth. "Would you sell it to me?"

"No. Nor will I give you everything that in your extravagance you demanded. Are you trying to empty all our stores so that we cannot deal with anyone else here?" The haggling went on for some time. It started to grow dark outside Gazar's hut of woven branches. Eventually they agreed on a price. Jennifer rummaged in her backpack. "Here are your two scalpels and fourteen knives. I will come back tomorrow with the bottle of tangleter," she said.

"I trust you so far," Gazar agreed.

"Now I must go back to my ship, while there is still some light." Jennifer stood up. She was not very tall by human standards, but she had to stoop to keep from bumping the ceiling of the hut.

Gazar scurried around to open the door for her, a courtesy she'd read of but one long obsolete on civilized worlds, where doors were smart enough to open themselves. "Until tomorrow," the Atheter merchant said.

"Yes." Jennifer started down the chain ladder the crew of the *Pacific Overtures* used to reach the lower branches of the big trees on which the locals lived. The Atheters carved what they reckoned hand-, foot-, and tail-holds into the forest giants' trunks, but for humans, who unfortunately lacked both opposable big toes and any sort of tails, prehensile or otherwise, ladders were infinitely preferable.

Gazar peered anxiously after her. "Be careful down there," he called. "The *omphoth* may be gone, but there are all manners of dangerous beasts."

"I have my weapon that throws sleep," she reminded him. He smiled a big-toothed, reassured smile, then

started screaming at the top of his lungs for customers. His shrieks were just a tiny part of the din, living as they did in an environment where they could rarely see far, Atheters advertised with noise.

Jennifer was relieved to descend to the relative quiet of the forest floor. She took out her stunner; she knew Gazar hadn't warned her just for politeness' sake. The ground featured not just the usual assortment of large mammaloid carnivores, but also poisonous lizardy things that struck from ambush out of piles of leaves. The thick boots she wore to protect herself against them were one more reason not to use the locals' routes up and down trees.

Being under those trees, Jennifer discovered, had other risks she hadn't thought of. Something whistled past her face, so close she could feel the breeze it raised, and smacked to earth just in front of her feet. She sprang back in alarm. Without her willing it, her finger went to the stunner's firing button.

But, she saw, it was only one of the big, knobby, hard-skinned fruits that fell from the Atheters's trees. As she looked around, she saw two or three more similar fruits and a couple of scraggly saplings that were not doing at all well as they tried to grow in the gloom cast by their elder relatives.

"A stupid seed," she muttered. Then she shivered. Stupid the seed certainly was, but had it fallen in a spot half a meter different, it would have smashed her skull. As she walked on, she cocked her head to look up every so often. Not just seeds fell from the Atheters's trees, but also rubbish the locals threw out.

After a few hundred meters, she

emerged from the forest into a large clearing, almost big enough to be an independent patch of plain. In the middle of it, sunset gleamed off the metallic bulk of *Pacific Overtures*. Jennifer blinked; after forest twilight, the crimson sun-reflections from the ship were dazzling.

She hurried toward it. Less than a hundred meters away, she stumbled over something and nearly fell. As she caught herself, she saw she'd tripped on a stump completely overgrown by grass and low bushes. It had been a big tree once; now it was just a menace to navigation.

She sighed with animal pleasure the moment she got inside *Pacific Overtures*. After the humid heat of the jungle, conditioned air was a blessing. She shook back her long blond hair, frowned at how heavy and limp with sweat it was. As she had before, she thought about cutting it short. But it helped the Atheters tell her apart from the other humans on *Pacific Overtures*, so she supposed it was worth the bother.

She was into the common room before she realized how much like a trader she was starting to think. Annoyed, she kicked at the carpet.

The scuffing noise made Sam Watson look up from the spice cones he was grading. His eyes lingered. That annoyed Jennifer all over again; hot, grubby, and none too clean, she felt anything but attractive. Men, though, usually seemed to think otherwise.

The once-over ended soon enough not to be offensive. "How'd you do?" Watson asked. "Get anything interesting?"

"As a matter of fact, I did." She took

Our first glimpse of Lewis Shiner's vision for DESERTED CITIES OF THE HEART came in a hotel room in Tucson, Arizona, during the World Fantasy Convention. We sat there while he told us about this novel he was working on. It had a little bit to do with contemporary Mexican politics. It had a little bit to do with Mayan culture and the legend of Kulkulkan. It had a little bit to do with this guy who had a serious longing for his brother's wife. And it had a little bit to do with Ilya Prigogine's theories, if you can believe it. And the writing found inspiration from novelists like Robert Stone. We sat there, listening intently, but quietly wondering to ourselves, "How is he going to bring this impossible story together?"

Funny thing is that he actually managed to do so. In fact, he managed to do so brilliantly. He did so to the point where the reviewer for the *Washington Post Book World* called it "the best book I've read in the sf and fantasy field this year," the *San Francisco Chronicle* called it "both a taut political thriller and a transcendental apocalyptic fantasy" and novelist James Ellroy (whose most recent novel, *The Black Dahlia* just hit the *New York Times* Bestseller List—congratulations, Mr. Ellroy) called it "savagely written" and "a total original."

We never doubted for a second that Lew could pull it off, mind you, but we were still stunned when we read it. He accomplished everything he set out to accomplish. Lew lives in Austin and we live in New York, but we're thinking of inviting him to join us in a hotel room in Tucson in the near future. Just so he can tell us some more impossible stories.



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the ivory figurine from her belt pouch, set it on the table in front of him. "Have you ever seen anything like this before?"

He reached for it, paused. "May I?" At her nod, he picked it up. He was a medium-sized, medium-brown man in his mid-thirties, three or four years older than Jennifer. She suspected he wore his bristly handlebar mustache for the same reason she kept her hair long: to give aliens something by which to recognize him. She couldn't think of any other reason for him to want a black caterpillar in the middle of his face.

The caterpillar twitched as he pursed his lips. "Can't say as I have," he said slowly. "That's an old, old style of carving."

"I thought so, too, though I haven't seen it before," she nodded. "Gazar—the merchant I got it from—says the animal whose ivory it comes from is a thousand years extinct."

"I wouldn't be surprised, though I've never met a merchant, human or otherwise, who wouldn't stretch things for the sake of profit. Still, it's a pretty piece." He handed it back to her. "If it really is as old and rare as all that, it might even be museum quality."

"Do you think so?" Jennifer felt her pulse race, as if Watson had said a magic word. In a way, he had. Private collectors had only private wealth with which to buy. Museums could draw on the resources of whole planets. If they started bidding against one another, they could make a trader rich for life.

"*Might* be, I said." Watson jabbed a rueful thumb at his spice cones. "One thing certain—none of these are. Some will help make prime Athet brandy,

some good brandy, and the rest rotgut. They'll all turn a profit, but no big deal."

"I suppose not." Jennifer daydreamed about what she could do with a really big profit. Heading the list, as always, was setting up—and then occupying—an endowed chair. She smiled, imagining the Jennifer Logan Endowed Chair for the Study of Middle English Science Fiction. No, of Middle English Literature, for her interests had broadened since she left the university. "But I'd need to find the *omphoths's* graveyard for that," she murmured.

Watson scratched his head. "The which? For what?"

"Never mind, Sam." Jennifer felt herself flushing. After so many years of ancient literature, she often found herself speaking a foreign language even when she used perfectly good Spanglish.

"All right." Watson shrugged. He was a pragmatic type who did not waste his time worrying about what was of no immediate use to him. That made him narrow, but within his limits acute. "Now that we know your ivory exists, we'll have to see if we can get more. Don't forget to tell Master Rodriguez about it."

"I won't. When do you suppose she'll be back?"

Watson shrugged again. "She's got some sort of complicated deal brewing with the treelords, so she may be gone days yet. Who can say?" He gave a wry chuckle. "Whatever she's up to, it's a lot bigger than the trinket exchange level we humble journeymen operate at."

"I suppose so." Jennifer still had mixed feelings about her rank. If she

hadn't made journeyman at the end of her first run, she wouldn't have had anything to fall back on when her try at a real job went up in smoke. Maybe she would have tried again instead of signing up for another trip.

Watson, she knew, would have told her it was much too late to worry about such things now. He would have been right, too. That didn't stop her.

Now he glanced longingly back toward his spice cones. "I'd better finish these, so I can see exactly what I've got. Congratulations on the ivory. I'm most sincerely jealous."

She smiled. "Thanks." She headed on to her own cubicle, shut the door behind her. The figurine went into her strongbox. She walked down the hall to take a fast shower. Then she did what she did during most of her free time: she got out her reader and went from modern times back to the days before English changed to Spanglish. She might not be teaching the ancient literature, but she still loved it.

This new tale wasn't science fiction but, she discovered as she read, it did show respect for rational thought. She laughed a little, quietly, at a pleasant coincidence between past and present. Even across a gap of a thousand years, such things turned up now and again. They only made her enjoy her reading more.

Master Merchant Celia Rodriguez called a crew's meeting two afternoons later. Jennifer made sure she was in the common room at the appointed time; Master Rodriguez's tongue could degauss computer chips when she got annoyed. The other five merchants who

made up the rest of *Pacific Overtures's* crew were equally punctual, no doubt for the same reason.

Jennifer loathed meetings, feeling they wasted time in which she could be doing something useful, instead. Sitting through a great many of them had only made that feeling stronger. She got ready to look interested while she thought about her ancient scientific detective.

Celia Rodriguez's first words, though, made her sit up and take notice: "The civilization in this whole tract of forest is in deep trouble." Master Rodriguez's take-it-or-leave-it delivery was a good match for her looks: she was about fifty, heavysset, with blunt features and iron-gray hair she wore short. She badly intimidated Jennifer. Most loud, self-assured people intimidated Jennifer.

"What do you mean?" demanded Tranh Nguyen. He was also a master merchant, though junior to Rodriguez. "Judging from the records of earlier trade missions here, technology is improving, the standard of living is up, and population per tree keeps increasing." A couple of others, Sam Watson among them, nodded agreement.

"You're right," Rodriguez answered at once. "None of that matters at all, though, because the forest itself is dying back. Dim lights!" she told the ship's computer, and the common room went dark.

"First image," she commanded. The computer projected a map onto the wall next to her. "The green shows the extent of this tract of forest at the time of the first landing on Athet, 250 years ago. Second image." The borders of the green patch changed shape. "This is about a hundred years ago. Note the

losses here, here, and here. Note also that the open space in which we are sitting appears during that interval.”

Jennifer thought of the stump she'd tripped over. That had seemed just one of the small things that made up a day. Now it looked more like a symptom of a much bigger problem.

So it proved. “Third image,” Rodriguez said. The map changed again. “This is where we are today. See how much bigger this clearing has grown, and the appearance of these two further west. See also where grassland has replaced forest here, and in this sector. The next map is an extrapolation of where these trends will lead if they keep on for another two hundred years. Fourth image.”

The new map that appeared beside the master merchant brought gasps of surprise and dismay from her colleagues. The broad expanse of forest that had dominated this part of the continent was gone, only a few small outcrops surviving like islands in a sea of grass.

“This, of course, spells catastrophe for the Atheter civilization here,” Master Rodriguez said. “The locals are so tied to their arboreal lifestyle that they have a great deal of trouble adapting to life on the ground. Their most likely response to the failure of the trees would be to try migrating to the next big forest tract, a couple of hundred kilometers away. That tract is already settled; I doubt its inhabitants would welcome newcomers with open arms.”

“Have you shown the treelords these maps?” Tranh Nguyen asked.

Rodriguez shook her head. “I prepared them last night, after our meeting.

The treelords realize they have a problem, but not its extent. As you said before, they can support more people per tree than they once could, which has helped mask there being fewer trees in which to support them. But now they have begun to notice.”

“What do they want us to do, then?” Nguyen went on, having the seniority to ask the questions the whole crew was thinking.

“We've spent 250 years building up our image as the wise, powerful traders from the stars. Now they want us to live up to it.” Master Rodriguez's smile was ironic. “They want us to make the forest grow bigger again. Not much, eh?”

This time, several people spoke at once: “How do they propose to pay for it?” It was the first question that flashed through Jennifer's mind, though she did not speak aloud. Her own smile was rueful. Yes, she thought like a merchant now, sure enough.

“I don't know,” Rodriguez said. “I don't know if we can, for that matter, but even trying will be expensive. And Athet has never been what you'd call a high-profit world. For something of this scale—” She let the words hang.

“I don't like the idea of standing by and watching a civilization go down the drain,” Suren Krikorian said. He was a journeyman hardly senior to Jennifer, but came from a wealthy family—he did not need to worry about the consequences of speaking his mind.

“Neither do I,” Celia Rodriguez replied. “I don't like the idea of bankrupting myself either, though. Even a preliminary study on the local problem will keep us here a lot longer than we'd planned, and that will be expensive. If

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we don't have something to show for it when we get back to *our* civilization, we'll all be badly hurt."

Krikorian scowled but did not answer. The master merchant was right, and everyone knew it. Jennifer suddenly got up and hurried away from the table. She remembered to say "Excuse me" just as she left the common room, but so softly she was afraid nobody heard her.

"I trust this will be interesting," Rodriguez said when she got back. By her tone, she did not trust any such thing.

Jennifer felt herself flush. "I—I hope so, Master Merchant," she said, wishing she could push arrogance into her voice whenever she needed it. She held up the *omphoth*-ivory figurine. "I—I was just thinking that if the Atheters have more pieces of this quality, they would help pay us for our time here."

Celia Rodriguez's voice changed. "May I see it, please?" Jennifer brought it to her. She examined it closely, then asked, "May I show it to the rest of our group?" Jennifer nodded. "Opinions?" the master merchant asked as she handed Tranh Nguyen the piece.

The merchants passed it from one to another. Finally, Sam Watson returned it to Jennifer. "Enough like this, and staying here may well be worth our while," Nguyen said. No one argued with him.

"I only hope there *are* enough pieces," Jennifer said. "The trader from whom I got this one told me that the animals from which the ivory came from have been extinct for a thousand years."

"Have they?" Now calculation was in Rodriguez's voice, and something

else as well—the purr of a predator that had just spotted dinner. "Then with a little luck, we may be able to clean out the whole supply. We'll sell a few pieces when we get back to civilization, leave the rest with our brokers while half a dozen other ships scurry out here to try to get in on the good thing. And when they come back empty—why, then we'll sell more, at four times the price."

Everyone in the common room grinned at Jennifer. She smiled back, a little uncertainly—attracting attention, even favorable attention, made her nervous. It did, however, beat the stuffing out of the other kind, she thought.

Gazar's crest rose. His tail thrashed. "Your people will be buying many *omphoth*-ivory pieces, you say?"

Jennifer nodded. "As many as they can. If you want more, if you want more to sell to us, now would be a good time to get them, before you have to compete with the lure of offworld goods."

"And if I do get them, you will trade those offworld goods to me?" The Atheter's golden eyes were big and yellow as twin full moons.

"Certainly," Jennifer said. "Provided, that is, that you remember the favor I have done you and keep your demands within the bounds of reason."

Gazar winced. "Now I understand why your teeth are so small, merchant from the stars—your sharp tongue long ago sliced off their points." He displayed his own formidable set of ivory.

"From you, I will take that as a compliment," Jennifer chuckled.

"I meant it as one," Gazar said. "You must understand me, even with

advance notice I doubt I will be able to get a great many pieces. *Omphoth* ivory has become rare enough over the years that most of it, now, is in the treasury of one treelord or another. Still, some may be persuaded to fall from the branch.”

“I hope so.” Jennifer paused. “Speaking of falling from the branch, I almost had my head smashed in by a falling fruit the other day.”

“I’m glad you escaped. Still, that shows the folly of going down to the ground, does it not?”

“Not what I meant.” Jennifer reminded herself not to be annoyed. Just as she was a product of her environment, so Gazar was of his. “I would have thought that you treefolk would take care to harvest those fruits for yourselves, and not let the ground creatures have the benefit of them.”

The Atheter made a horrible face. “Not even the crawlers in the leaves would want them. Our trees are wonderful. They are our lives, they are our livelihoods, they are our homes. But we do not eat their fruits. They taste dreadful.”

“Oh. All right.” Jennifer thought for a moment. “But you have many different kinds of large trees in this forest. Surely some must be of use to you.”

“A few,” Gazar said grudgingly, as if making an enormous concession. “Most, though, are truly foul—better for weapons, as you saw, than for food.”

“You know best, I’m sure.” Jennifer stood up, as well as she could inside Gazar’s shop. “I’ll come back again in a few days. I hope you’ll have found some *omphoth* ivory by then.”

“So do I,” Gazar said. “My mate is pregnant with a new set of twins, and I expect we will need a larger house after they are born. The more offworld goods I get from you, the sooner I can buy it. Maybe I will buy a slave or two as well.”

Jennifer was glad Atheters had trouble reading human expressions; she was afraid her revulsion showed on her face. *You are not here to reform these people*, she told herself. Until they industrialized, they probably would have slaves, and there was nothing she could do about it. No, not quite nothing—trading with them was bound to spur their own technology, which might hasten the day when slavery grew uneconomic here.

As she walked back to *Pacific Overtures* this time, she kept a wary eye on the treetops. When a big fruit crashed down into the bushes, maybe fifty meters off to her left, she almost jumped out of her skin. No missiles came any closer than that, though, for which she was duly grateful.

Back at the ship, she gave herself the luxury of a few seconds of gloating. A small private hoard of *omphoth* ivory couldn’t help but improve her credit rating when she got back to civilization. A large private hoard would be nicer yet, but she knew she lacked the resources to get her hands on one.

Maybe next trip out, she’d score that really big coup. . . . She stopped in dismay. That was thinking too much like a trader to suit her. If she got a decent stake out of this run, she’d be able to afford to look for an academic job.

“And if I land one,” she said aloud, “I’ll never go to a world that doesn’t

have an automated information retrieval system again."

Pleased at that promise to herself, she dug out her reader and returned to twentieth—or was it nineteenth?—century London. The more stories she read about this detective, the more she wanted to read. That surprised her; the fellow who wrote them had also turned out a lot of bad science fiction. But the detective and his amanuensis lived and breathed. These tales were what the writer should have been doing all along, instead of wasting his time on things he wasn't good at.

She put down the reader, fought back angry tears. What was she doing aboard *Pacific Overtures* except wasting her time on things she wasn't good at?

Tranh Nguyen made as if to bang his head against the corridor wall. "I don't know why the forest is shrinking," he growled. "As far as I can tell, the soil in the grasslands is the same as the soil where the trees still grow. It has the same mineral content, the same little wormy things crawling through it, the same everything."

"Not the same everything." Celia Rodriguez shook her head. "It doesn't have trees on it any more. We still have to find out why."

"Excuse me," Jennifer said—softly, as usual.

Neither master merchant paid any attention to her. Tranh Nguyen said, "I know we have to, but I'm not sure we can. I do what the computer tells me to do, I compare the results of one sample to those from another, but if nothing obvious shows up, I'm stuck. I can't make the intuitive leap—I'm a trader,

after all, not an agronomist who might see more than is in the computer program."

"Excuse me," Jennifer said again.

"An agronomist!" Rodriguez clapped a hand to her forehead. "As if we could afford to haul an agronomist all the way out here! As if we could find an agronomist crazy enough to want to come! We have to be able to do this kind of work for ourselves, because if we don't, no one will."

"I know that as well as you do," Tranh Nguyen said. "Why carry the big computer library, except to make sure we can do a little of everything? A *little* of everything, though, Celia, not everything. We may really need a specialist here. Right now, I'm stymied."

"Excuse me," Jennifer said one more time.

Celia Rodriguez finally noticed she was there. She stepped out of the way. "Why didn't you say something?" she demanded.

Jennifer shrugged and walked by. She was often effectively invisible aboard *Pacific Overtures*. She much preferred that to the way things had been on her last trading run, when two male journeymen, neither of whom she wanted in the least, had relentlessly hounded her through the whole mission.

Sometimes she wished she were chunky and hard-featured like Celia Rodriguez instead of slim and curved and possessed of an innocent look she could not get rid of no matter how hard she tried. She would have enjoyed being valued for herself instead of just for her blue eyes. She'd never found a tactful way to say that to the master merchant,



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though, and so sensibly kept her mouth shut.

She let herself into her cubicle, closed the door after her. That cut off most of the noise from the corridor, where Rodriguez and Tranh Nguyen were still arguing. She carefully took off her backpack, set it on the floor. Then, grinning, she leaped onto her mattress and bounced up and down like a little kid.

When she was done bouncing, she got up again and opened the backpack. Inside, wrapped in a square of thick native printed cloth that was a minor work of art in itself, lay two fine *omphoth*-ivory figurines. One was a carving of an Atheter; but for its age, Jennifer would have guessed it a portrait of Gazar. It certainly captured the local merchant's top-of-his-lungs style—she could practically see the fur rising on the figurine's back.

That piece was excellent, but it paled beside the other. "This," Gazar had said, swelling up with self-importance, "is a veritable *omphoth*, carved from its own ivory to show later generations the sort of monsters we had to battle in those ancient days."

To a tree-dweller, Jennifer had to admit, it must have looked like a nightmare come to life. She thought of an elephant's head mounted on a brachiosaur's body, though the ears were small and trumpetlike, the tusks downcurving, and the trunk—miraculously unbroken on the figurine—seemed to be an elongated lower lip rather than a nose run rampant. Such details aside, the carved *omphoth* certainly looked ready to lay waste to whole forests.

Imagining a full-sized one, Jennifer had had trouble seeing how the Atheters

could have ever killed it. When she said as much to Gazar, he'd burst into epic verse in a dialect so antique that her translator kept hiccuping over it. Apparently a band of heroes had gone out into the Empty Lands, brought back an immense boulder, somehow manhandled it up into the treetops, and then dropped it on an *omphoth*'s head.

"Thus was the first of the monsters slain," Gazar had declaimed, "giving proof—could be done again." Jennifer remembered staring at her translator; the machine was programmed to produce rhymes like that.

Now, though, she was more interested in the statuette than in the poetry its model had inspired. No matter how many treelords ransacked their collections for Celia Rodriguez, she did not think the master merchant would come up with a finer piece.

How much would the *omphoth* be worth? Enough to set up an endowed chair of Middle English literature? Jennifer knew she was dreaming. The whole hoard *Pacific Overtures* was bringing back might be worth something close to that, but her few private pieces wouldn't come close.

She sighed, rewrapped the figurines, and put them in her strongbox. One of these days, she told herself—most likely, just about the time when she would start forgetting her Middle English.

No, that was unfair. She loved the old language (although perhaps it wasn't older, she thought, surprised, than Gazar's hunting epic), and kept fresh her command of it. Fiche and a reader even a journeyman could easily afford.

She settle in with her scientific detective. This tale, part of what was

called his memoirs, had to do with horse-racing. Jennifer had seen a great many alien beasts on her trading runs, but never a horse. She had to struggle to work out from context what several of the words in the story meant; she was always rediscovering how large a vocabulary Middle English had. Even so, as she usually did, she got the gist of the piece, and smiled at finding an exchange that had passed straight into Spanglish:

“‘*Is there any point to which you would wish to draw my attention?*’

‘*To the curious incident of the dog in the night-time.*’

‘*The dog did nothing in the night-time.*’

‘*That was the curious incident,*’ remarked Sherlock Holmes.”

She finished “The Silver Blaze,” loaded the fiche *Oxford English Dictionary* into the reader so she could look up a few words that had completely baffled her. But her mind kept going back to the dog that had not done anything. She frowned, trying to figure out why.

Then her eyes got wide. She reached under the bunk for her strongbox. She got out the two figurines she had just bought from Gazar. She looked from one of them to the other, then slowly nodded. This had to be how Holmes felt when all the pieces fell together. She quoted him again: “When you have eliminated the impossible, whatever remains, *however improbable*, must be the truth.”

“Excuse me, Master Merchant.” Jennifer had to say it three times before Celia Rodriguez noticed her. She didn’t mind; she was used to that.

Finally Rodriguez looked up from her

computer screen. “You want something, Jennifer?” She sounded surprised. Jennifer didn’t mind that, either. She usually kept a low profile.

“Yes, I think so, Master Merchant. That is, I think I may know why this forest is shrinking.”

Rodriguez slammed a meaty hand down on the panel in front of her. “Well, if you do, that’s more than anyone else does. And I haven’t seen you doing anything in the way of trying to find out, either. So how do you know? Divine inspiration?”

“No. I—I—” Jennifer had to work to keep her voice audible in the face of such daunting sarcasm. “I—I got the idea from a Middle English book I was reading.”

The master merchant groaned. “Jennifer, I don’t begrudge anyone a hobby. Tranh Nguyen keeps trying to beat the computer at chess. He’ll keep trying till he’s a hundred and five, if he lives that long. Me, I like to knit. That’s even useful, every now and then. I’ve traded things I’ve made for more than they’re worth. You have your ancient books. They’re harmless, I suppose. But what can they possibly have to do with why this forest tract on Athet is getting smaller?”

“It’s—a way of thinking. But never mind that now. You’re right, Master Merchant, I haven’t done much work on the problem till now. I’m sorry. But can you tell me if you have maps that show the boundaries of the forest from a long time ago? Long before we first landed here, I mean—back when the Atheters were first settling this territory.”

“I think so, yes.” Rodriguez fiddled

with the computer. A map appeared on the screen, replacing the chart she had been studying. "As best we can tell now, this is the size of the forest about 1,500 local years ago. It started declining then, slowly at first, but more and more rapidly in the past millennium. The process was well under way when humans came here, for reasons we still can't fathom—no great climatic changes, no shifts in the nature of the soil, nothing."

The master merchant checked herself, glanced sourly at Jennifer. "Oh, I'm so sorry. Now you know why, out of your antique books. Enlighten me, please."

Jennifer took a deep breath. If she was wrong now, the fitness report Rodriguez turned in on her would make it next to impossible for her to fly again. After not getting a fair shot at one career, the prospect of washing out of another frightened her more than she was willing to admit, even to herself.

"I think it was—" She spoke so softly that Rodriguez had to lean forward to hear what she was saying. She involuntarily yelped, "—the *omphoth*."

"The *omphoth*?" The master merchant looked disgusted. "You come in here, waste my time with this foolishness when I have serious work to do? The *omphoth*," she said, as if to an idiot child, "have been extinct for a thousand years. You were the one who found that out. How can something that isn't here any more have anything to do with conditions now?"

"By not being here," Jennifer said. Rodriguez snorted, turned back toward the computer screen. "No, wait!" Jennifer said desperately. "The forests

really started shrinking a thousand years ago—you said so yourself. And the Atheters here finished wiping out the *omphoth* a thousand years ago. Don't you think there's a connection?"

"Coincidence," Rodriguez snorted. But she did look at Jennifer again. Now she might have been talking to a clever child: "Be reasonable. The Atheters got rid of the *omphoth* because they kept eating up the forest. So why is it shrinking now that they're gone?"

"Yes, they ate the trees," Jennifer agreed. "They even ate the horrible fruits that the Atheters can't stand, that none of the animals that are still around want anything to do with. What happens to the fruits that fall to the ground now?"

"They sprout, of course."

"Yes." Jennifer nodded eagerly. She was so full of her idea, she was almost fluent. "They sprout. They sprout under the trees that dropped them in the rain forest gloom. Not many grow up, and the ones that do only grow up in the same place trees had always been."

"So what do the *omphoth* have to do with any of that? If they eat those fruits, they digest them, don't they? That gets rid of them a lot more thoroughly than trying to grow in the shade."

"They digest the fruit, yes, but what about the seeds inside?" Jennifer asked. "Lots of plants on lots of worlds disperse their seeds by passing them through animals' guts. I looked that up when I first wondered if there was any connection between the *omphoth* disappearing and the forest shrinking back."

"Do they? Did you?" Now, at last, Celia Rodriguez began to seem interested.

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“Yes. It makes sense here, too, in ecological terms. It really does, Master Rodriguez. The *omphoth* ate fruit nothing else here likes at all. Doesn't that probably mean they and the trees evolved together? The trees provided them a special food; in return they disseminated the seeds inside. And so when they disappeared, the seeds didn't get disseminated any more, and that's what I think has made this tract of forest get smaller.”

“Hmmm.” The master merchant pulled out her lower lip, let it snap back with a soft plop. “You've done your homework on this, haven't you?”

“Of course I have, Master Rodriguez.” Jennifer knew she sounded surprised. If she was good at anything, it was research.

“Hmmm,” Celia Rodriguez said again. “Well, what do we do even if you're right? The *omphoth* are extinct. We don't have a machine to bring them back.”

“Ooh.” It was like a blow in the belly—Jennifer hadn't thought that far ahead.

But once the master merchant had an idea, she was not one to let go of it. She said, as much to herself as to Jennifer, “They're extinct here, anyhow. But this isn't the only tract of rain forest on Athet, not by a long shot. It's just the one offworlders do the most business with. Maybe others have relatives of the *omphoth* still running around loose.”

“It shouldn't be hard to find out,” Jennifer said.

Celia Rodriguez barked a couple of syllables' worth of laughter. “No, not hardly,” she agreed. “Even with our translators barely working, the way they act when they're still picking up new

languages, the locals won't be in much doubt about whether they have *omphoth* around.”

Jennifer thought of something else. “I hope the main hold is big enough to carry one. More than one, I mean, if we intend to establish them here.”

“First things first.” The master merchant laughed again. “Hope the stunners are strong enough to put them under. Otherwise, I suppose we'll have to herd them across the however many hundreds or thousands of kilometers it is from where they are to here. And for that”—Rodriguez's tone was still bantering, but Jennifer had no doubt she meant what she said—“for that, I would definitely charge extra.”

Something went crashing through the undergrowth far below the branch on which Gazar's establishment was perched. Then the something—Jennifer and Gazar both knew what it was; nothing else made that much racket—let out a bellow that sounded like a cross between a kettledrum and a synthesizer with a bad short in its works.

Gazar made a ghastly face. “Now I know why our heroic ancestors slew all the ancient *omphoth*—in the hope of getting a good night's sleep. The cursed beasts are never quiet, are they?”

“They don't seem to be,” Jennifer admitted. The newly released animals' cries could be heard even inside *Pacific Overtures*.

Out along the branch, Atheters shouted and screeched. Jennifer's translator screeched too, protesting the overload. It did manage to pick up one call: “Come on out, Gazar, and look at the *omphoth*! Here it comes!”

“Why should I want to see the creature that torments my rest?” Gazar grumbled, but he went. Jennifer followed more slowly, the hobnails in the bottom of her boots helping to give her purchase on the branch.

Young Atheters squealed and clung to their mothers’ fur as the *omphoth* lumbered by underneath. It took no notice of the excited locals in the tree; its attention was centered solely on food. It pulled up a bush, spat it out—it was still learning what was good in this new forest and what was not.

“It doesn’t look the way an *omphoth* is supposed to,” Gazar complained; having found that figurine for Jennifer, he fancied himself an expert. “It doesn’t even have tusks.”

He had a point, she supposed. The new beasts were not identical to their exterminated cousins. Not only were they tuskless, but their lower-lip trunks were bifurcated for the last meter or so of their length. They hardly had any tails, either, and their hooves were smaller than those of the *omphoth* this forest had once known.

But in the one essential way, they were like the *omphoth* of old: they were ravenously fond of the big knobby fruits the various trees produced. The *omphoth* under Gazar’s tree bent its head down so its forked trunk could grab fruit that had fallen to the ground. Wet chewing noises followed.

Then the *omphoth* reached up almost as high as the branch on which Jennifer was perched. If the baby Atheters had squealed before, they shrieked now. Jennifer could not blame them. The sight of that open pink maw only a few

meters away made her want to shriek, too. The *omphoth* had dreadful breath.

It was not interested in snacking off the locals, though. All it wanted to do was pluck more fruit from any branch it could reach. Finally it stripped those branches bare and stamped away to look for more fodder.

Gazar turned around to display his hindquarters at it, a gesture of contempt he had never been rude enough to use on a human. He caught Jennifer’s eye. “Some treetowns are even less happy with these beasts than ours,” he said. “I only hope they are not so short-sighted as to try to get rid of them.”

“Why would they do that?” Jennifer exclaimed in horror. “The *omphoth* are saving the forest for you.”

“Saving the whole, aye, but damaging the parts. We have laws against building on branches lower than a certain height.” Gazar blinked. “I suppose one reason we have those laws is the *omphoth* of long ago. I never thought about it till now. But not every treelord enforces those laws—without *omphoth*, they matter little. Now there are *omphoth* again, and they’ve already wrecked some houses that were low enough for them to reach.”

“Oh. I’m sorry to hear that,” Jennifer said. “Your people had better know, though, that we won’t be around to get more *omphoth* for them if they go and kill these. You need to build up the herd, not destroy it.”

“The treelords know that,” Gazar said, still sounding a long way from happy at the prospect. “Armed males travel through the trees to guard the beasts from harm.”

“I should hope so,” Jennifer said.

After all the trouble the crew of *Pacific Overtures* had gone through in stunning and transporting the great beasts, the idea of having them hunted down was appalling.

She took her leave from Gazar, climbed down the chain ladder to the ground. The *omphoth* was nowhere to be seen, although she could still hear it somewhere off deeper in the forest. She was glad it was not between her and *Pacific Overtures*.

Immense footprints and crushed bushes showed the beast's path. So did a huge pile of steaming, stinking green dung. In the dung Jennifer saw several teardrop-shaped seeds.

She smiled. These particular seeds got not great advantage from their trip through the *omphoth's* gut. But *omphoth* also wandered out to the edges of the savannah country surrounding the forest. Seeds deposited there would be more likely to thrive. With luck, the forest would grow again.

Her smile grew broader. All too often, pre-industrial races wanted nothing more from traders than help in war against their neighbors. This time, though, the crew of *Pacific Overtures* had really accomplished something worth doing. They'd turned a profit on the deal, too. Jennifer had learned to think well of the combination. She hurried toward the ship.

An *omphoth* came out of the forest. Sam Watson stepped up the gain on *Pacific Overtures's* viewscreen. He and Jennifer watched the beast's pupils shrink in the sudden bright sun. It didn't seem to like the feeling much. With a bellow, it drew back into the shelter of the trees.

Watson yawned and stretched. "I'll almost miss the big noisy things," he said.

"Yes, so will I, but not their noise," Jennifer said.

"No, not that. Maybe the next ship in can see if coffee does for Atheters what it does for us. I suspect a good many of them will need it, though they're not what you'd call a quiet species themselves."

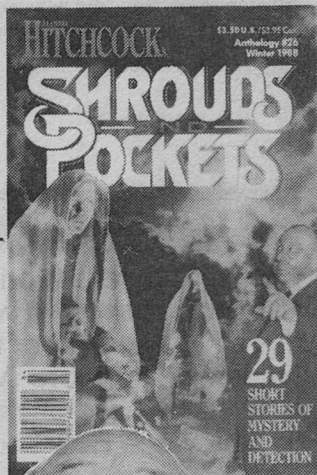
"Hardly." Thinking of Gazar, Jennifer knew that was, if anything, an understatement. After a moment, she went on, "Maybe we should have done some tests with the coffee in the galley. If it worked, they'd have paid plenty for it."

"Too late to worry about it now, what with us upshipping tomorrow. I wonder how much the ivory will end up bringing. The way Master Rodriguez has things lined up, we may take a while selling everything, but we'll get a lot when we finally do. It's especially nice," Watson added, "that the new kind of *omphoth* we've introduced here doesn't have tusks; the Atheters won't have the incentive of hunting them to carve more trinkets for traders."

"That's true," Jennifer said. "I wouldn't feel right if we'd brought them here just to have them killed off."

"No." Sam gave Jennifer an admiring look. She hardly noticed it; she was used to admiring looks from men, and used to discounting them, too. But this one proved different from most. "That was a lovely piece of analysis you did, Jennifer, working out the connection between the extinction of the old *omphoth* and the trouble the forest was having."

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She felt her cheeks heat with pleasure. "Oh. Thank you very much."

"I ought to thank you, for bumping up our profits, and I suppose for the Atheters too. How did you ever work out that the *omphoth* passed the seeds through their intestinal tracts and then

out again?"

"That? It was—" Jennifer paused, knowing he wouldn't understand—he was just a merchant, after all, not a scholar of Middle English. She found she didn't care. "It was alimentary, my dear Watson." ■

IN TIMES TO COME

● Marc Stiegler's April cover story, with cover by Todd Hamilton, is short in words and vast in scope. Pioneers in the emerging field of nanotechnology foresee changes in human life far more sweeping than those of the past, yet even those have often strained people's abilities to adapt to new ways. How can they ever adjust to changes of the magnitude to come? Well, nobody could seriously contemplate *jumping* the length of the Appalachian Trail, but there are people who *walk* it. . . .

Of course, individual steps of a long journey can sometimes be difficult and treacherous. Our fact article next month is "Zero Gravity and the Immune System: A Challenge to Man's Survival in Space," by J. Kevin Steele, an immunologist at the Harvard Medical School. It seems prolonged exposure to weightlessness does funny things to the human immune system, things which are not fully understood but will have to be dealt with before the advance into space can go much farther. Considering the advantages such knowledge could have in dealing with certain other problems right here on Earth, this kind of research could be yet another reason for pushing the space program vigorously forward.

We'll also have a variety of stories, some by writers you already know and like, such as Harry Turtledove, Joseph H. Delaney and Rick Cook; and others by a couple of promising newcomers.

Donald F. Robertson

MARS: THE SOVIET MARCH

The Russians are going to Mars.

They are going immediately (they will be on their way as you read this) and on a scale inconceivable to the west.

Public discussion of these plans by Soviet scientists has been largely ignored in the Western news media. So the sheer scale of Russian ambitions for Mars may surprise even people who are generally aware of space activities—like readers of *Analog*.

Initially, the Soviet Union will use automated spacecraft to scout the entire Martian system. This will prepare the way for returning multiple samples of the planet's surface to the Mir space station, currently being built in low Earth orbit. Judging by the character of these missions, Soviet statements, and activities ongoing in Earth orbit, all of this seems intended to lay the foundations for human missions—although these will almost certainly happen later rather than sooner.

These plans *are* a surprise; a sudden and complete reorientation of the apparent aims of Soviet planetary exploration. For more than a decade Russian automated planetary missions have con-

centrated on Venus¹ leaving the rest of the Solar System for the United States to explore in its own more-off-than-on style.

The apparent suddenness of this change indicates a great deal to watchers of the Soviet space program. At the Red Star 2000 Conference on the "Soviet Space Challenge," sponsored by the University of Huntsville, Alabama, James T. Westwood, a civilian consultant to the United States military, told me that he is aware of, at most, three instances since World War II where the Soviet Union has altered even its detailed naval planning. Once Russia establishes a technological policy, it is almost never changed.

Westwood believes that at some point the Soviets decided that nuclear power and spaceflight represented the long term solutions to what they conceive to be their major problems, and that decision has survived all subsequent political changes.

For example, while Three Mile Island

¹Where it may not be entirely a coincidence that the inhospitable environment makes human missions inconceivable with any foreseeable technology.

stopped the United States nuclear industry cold,² at least one of Russia's Chernobyl reactors, of discredited design, has already been restarted. Nuclear power and spaceflight are now constants in the Soviet world view and nothing short of absolute failure will change that.

Nicholas Johnson, an Advisory Scientist to Teledyne Brown Engineering and one of the West's foremost civilian experts on the Soviet space program, related this technological tenacity to Russia's space program in the 1988 edition of his annual report "The Soviet Year in Space." He said that "the most remarkable aspect of . . . 1987 is that it was unremarkable. The 95 missions conducted were only one shy of the annual average for the decade of the 1980s. Since 1980, more than 30 new space systems have been introduced . . . an average of four per year. During four of those eight years, new manned endurance records were set, and two new space stations were launched. Six sophisticated Soviet probes were sent out into the Solar System . . . while the United States launched none. . . ."

Soviet technological planning, then, is conservative in the extreme; or, as Westwood puts it, "highly routinized (and characterized by) relentless regularity. . . . Changes in priority are very rare and must come all the way from the Central Committee" of the Communist Party.

So, the questions we will examine are: What has caused this inherently conservative government to look, with ap-

²I doubt it will recover until shortages of fossil fuels and the CO₂ problem make all the alternatives untenable.

parent suddenness, to Mars? What does Soviet concentration on Mars portend for the future? And what should be the western response?

First, we will look at the near-term Mars program—the Soviets have been remarkably free with information—and then, briefly, at the hardware the Soviets have available for their longer-term ambitions.

In July 1988 two Proton rockets launched giant, automated spacecraft toward the Mars system. These newly designed "Phobos" ships, named after their first target, weigh 6,220 kilograms. This is much more massive than any Western interplanetary spacecraft.

The Proton Rocket's ability to throw relatively great masses toward Mars, combined with a new willingness to attempt complex maneuvers before leaving Earth orbit, provides the Phobos craft with a large total maneuvering capacity. This, combined with a two-stage design, results in new flexibility in the kinds of missions the propulsion system is capable of performing. The first stage propulsion module on each craft contains a new, highly advanced, turbine-fed, steerable rocket fed by eight fuel tanks. A second stage, using similar elements, is integrated directly to the spacecraft.

A high gain antenna for communications with Earth is mounted on the "upper" side of the spacecraft, hinged with a two-degree-of-freedom gear. Twin sun-pointing solar panels support altimeter and doppler radar antennae on their undersides and hold attitude control thrusters away from the vehicle's

center of gravity. In sharpest contrast to Western spacecraft, the Phobos ships are not open to vacuum but are pressurized, the interior gas being circulated to external radiators to provide cooling for the electronics.

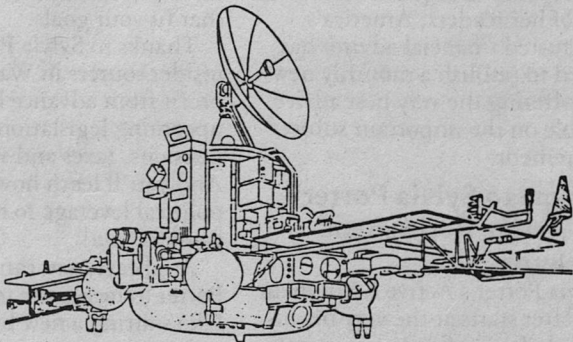
The scientific payload of each Phobos ship totals two hundred kilograms and thirty instruments, according to Roald Kremnev, director of the Babakin Center of Moscow's new civilian space agency, Glavcosmos. He spoke at the first International Conference on Solar System Exploration in Los Angeles, California. Both of these numbers are much higher than is typical of western automated spacecraft.

This new generation of interplanetary ship, like the old, will be mass produced. This allows the Soviets to send many spacecraft into the Solar System at relatively low cost. Later missions can immediately answer questions brought up by previous missions. The United States, with no such mass production philosophy, has yet to launch a mission to clarify the ambiguous re-

sults returned by the *Viking's* sophisticated but prohibitively expensive biology experiments. Emphasizing the new design's versatility, the Soviets have said that the ships' "multi-tank configuration . . . gives the possibility to optimize the spacecraft design for Venus, lunar, and other missions. . . . If it proves necessary to perform landings on a celestial body, it could be reequipped with a landing device."

The Phobos mission to the Martian moons is only the beginning: the earliest and simplest of the missions the Soviets have announced for the Mars system. Further flights using the same basic spacecraft consist of a detailed reconnaissance of Mars itself, provisionally planned for 1994, including orbital mapping, balloon flights, and small rovers; a dedicated rover mission some two years later to retrieve samples of the Martian surface; and what will probably be two dedicated missions spread over two or more years to get those samples from the surface and back to Earth.

The mapping mission, with two



External Appearance of Phobos AMS [Unmanned Interplanetary Station]

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spacecraft in a polar Martian orbit, is in final definition and will almost certainly gain approval from the Soviet government. The most important experiment—so important that it has recently been decided to risk untried aerobraking into Martian orbit to increase the payload—is a super-high-resolution orbital telescope attached to a film camera. Soviet scientist Lev Mukhin told a NASA Ames Research Center conference on “Exobiology and Future Mars Missions” that the idea is to map some one-third of Mars at less than one meter resolution to locate potential landing sites for the later sample return rovers.

The Soviets must have originally planned to develop the film on the spacecraft and transmit the results to Earth, much as the United States did with NASA’s Lunar Orbiter spacecraft. However, Soviet scientists realized that photographing one-third of Mars at one meter would result in an almost inconceivable amount of information—so much that Mukhin said it would take 238 years to transmit over the radio link. The solution was straightforward if far from simple: Engineers want to practice the sample return mission anyway, so the film is to be physically returned to the Mir space station in a return capsule.

The orbiter also carries a low-resolution meteorological camera to photograph the entire planet every other day with a resolution of one to five kilometers. Two more cameras map the surface in stereo at several hundred meters every one hundred days, and still another set of cameras photograph parts of Mars at resolutions of some tens of

kilometers.

Two landers drop to the red deserts of Mars. Small rovers range up to 125 kilometers with cameras for panoramic photography, and gamma-ray and fluorescence X-ray spectrometers to study the chemical composition and atomic structure of the regolith. They may also carry “vibro-penetrators,” potentially able to dig as much as twenty to thirty meters deep, where they may look for life and listen for “Marsquakes.”

Balloons are released from the upper hemisphere of each lander’s aeroshell immediately after landing. The four thousand cubic meter helium-filled balloon is a “montgolfier,” a metallic-colored inverted enclosure open to the air at the bottom. During the day, these vehicles cruise at an altitude of around two kilometers, photographing Martian deserts with centimeter resolution visible-light and infrared cameras. At sunset, the air trapped by the montgolfier cools, the balloon by itself cannot provide enough lift to keep the vehicle aloft. The whole contraption falls very rapidly from the twilight sky, without losing irreplaceable helium from the upper balloon. During the night, with the gondola resting on a desert floor, X-ray and gamma-ray spectrometers analyze surface composition and construction. Next morning, the rising sun warms the air in the montgolfiere, until the whole thing rises back up into the pink Martian sky.

This is the “Mars-1994” mission—“You (Americans) think of important things like the name (of a mission) much earlier than we do,” said Lev Mukhin (although Nicholas Johnson has sug-

gested the spacecraft may be called "Columbus"). Whatever it is called, the mission should provide the Soviets with a detailed model of what the Martian environment as a whole is like. This is in sharp contrast to the United States's Viking project, which concentrated on detailed biological investigations at two small areas—at the expense of the reconnaissance that would have been of use to later missions. This information is to help Russian engineers put the final touches to operating plans for two new and improved rovers, to be sent to Mars perhaps two years after the reconnaissance mission, around 1996.

These seven- to eight-hundred-kilogram automated vehicles range over the Martian deserts for up to 500 kilometers. The scientific payload is an enormous 150 kilograms but, beyond cameras, specific experiments have yet to be definitively chosen. The two-year mission of these rovers is to collect samples. Once that is done, they find a flat desert in which to wait, and turn on homing beacons.

In the next launch window, two years later, two "ascent vehicles" are sent to Mars. They have a month or two in orbit to search, presumably with cameras, for the landers sitting somewhere far below in the vast Martian wilderness. They then home in on the beacons and land as close as possible to the two-year-old rovers, or, if the latter can't be found, on a suitably flat desert. In that case, a more limited suite of samples is collected by a new set of small rovers based from the ascent vehicles.

Samples loaded, the ascent vehicles immediately ignite their rockets and flee

to the relative safety of a 500 kilometer orbit.

Either in the same launch window, or two years later, two "Earth return vehicles" are sent to Mars and enter orbits of 550 kilometers, 50 kilometers above the ascent vehicles' orbits. The newcomers have a month or so to find and rendezvous with the older spacecraft. Samples are transferred, then the return vehicles fire rockets to place themselves on trajectories back toward home.

In Earth orbit they are maneuvered to a special biological and chemical isolation module on the *Mir* space station. Once checked for safety, the samples are shipped to the Soviet Union, presumably over a period of time as cosmonauts are rotated to and from the station.

The Soviets are not planning to concentrate on just one planet as they have in the past. Their expanded planetary program intends to send reconnaissance missions to a representative cross section of main belt asteroids. Closer to home, a lunar far side sample return mission is planned to test technology for the Mars-1994 mission. This will conduct all the sample retrieval and orbital rendezvous operations discussed above, only in lunar orbit. Around the turn of the century, the Soviets plan an automated lunar geochemical laboratory, including rovers, to prepare the way for human missions to Earth's moon. Initial reconnaissance of the outer Solar System is also under consideration including, most spectacularly, balloon probes of that most mysterious of worlds, Saturn's great moon Titan.

Soviet scientists have admitted that all this is only a general outline of what they would like to do. The exact sequence and character of individual missions is subject to change, as the recent addition of aerobraking to the Mars-1994 mission makes clear. Soviet scientists have also said that none of the missions beyond Phobos—even Mars-1994—have obtained final approval from the Soviet government, although, since they are actively trying to line up international cooperation, it seems likely that most of the proposed missions will be approved. And, as discussed in the introduction, once OK'd by the government, these missions are a certainty.

Can they do it?

The Venera project at Venus is vastly underestimated in the west, presumably because Venus is a relatively uninteresting target—at least when considering near-term human bases. The Soviet Union managed to land a functioning spacecraft on what is arguably the most difficult to reach of any planetary surface in the inner Solar System—and did it five years before *Viking* landed on relatively benign Mars. They photographed and studied Venus's surface from more landing sites than has been achieved on any other world save Luna. They moved samples from Venus's high-pressure, high-temperature, super-corrosive environment into the bodies of landers without exposing the delicate instruments therein. Some Western scientists consider this the single most impressive engineering achievement so far attempted off Earth.

All of this was accomplished through

persistence. In the early years of the Venera program, the Soviets absorbed a failure rate that would have been political suicide to any Western space program. However, by sending two or more spacecraft toward Venus at almost every launch window throughout the 1960s and 1970s, when one spacecraft failed, they could simply fix the problem and try again. When an individual experiment failed, there was always another mission in a couple of years on which to fly an improved version.

Since the Soviets do not count money in the same way the West does, there is no real way to tell how much all of this costs. Considering the advantages inherent in mass producing spacecraft and launch vehicles—on a scale not attempted in the west since the late 1950s—it is possible the Venera project did not cost all that much more than the United States's policy of producing specialized one- or two-of-a-kind spacecraft.³

The Soviets accomplished most of the Venera project with a space infrastructure substantially more primitive than that of the United States. The latter country used high energy liquid oxygen/liquid hydrogen upper stages almost from the beginning (1963), a technology the Soviets are only now beginning to introduce 25 years later. It was this, along with phenomenal spacecraft reliability, that more than anything else made possible the American "golden age" of planetary exploration of the 1960s and early 1970s.

³This is not to say there aren't advantages to the American way: it was, after all, the United States that mapped much of the rest of the Solar System in less than two decades.

Now, the situation is reversed. In addition to the kind of centralized commitment from the highest levels of government the United States hasn't seen since the early days of the Apollo program, the Soviets have two operational advantages that the United States does not: the Saturn-class heavy lift vehicle, *Energia* (as well as its attendant space shuttle), and a permanent human infrastructure in low Earth orbit. Much has been made of these two new factors, but their potential is still underestimated.

With *Energia*, if useful and economic launch rates can be achieved, the Soviets can do almost anything they want through sheer brute-force launch of however much mass it takes. *Energia* is liquid fueled and uses relatively simple main engines, and thus has the potential to become reliable in a way the solid-fuel boosted space shuttle with its super high performance Space Shuttle Main Engines, will never be.⁴

Energia is also relatively benign environmentally, burning kerosene and oxygen in the boosters, and hydrogen and oxygen in the core. Even if everything else had gone right, acidification of the environment would have placed a relatively low limit to the number of space shuttle solid rocket boosters that could have been launched. Thus, a liquid-fueled rocket, burning benign pro-

pellants can remove a major constraint on the amount of mass that can be lofted to orbit over the lifetime of a launch vehicle. The Soviets are publicly stating that the purpose for which *Energia* was developed is to launch vast solar power satellites to broadcast solar energy—hence the launcher's name—as microwaves to receiving antennae on Earth. This provides some idea of the huge launch rates contemplated.

The Moscow Television Service reportedly said that *Energia* is capable of sending thirty-two metric tons to Luna (more than the U.S. *Space Shuttle* can loft to orbit) and twenty-seven metric tons to Mars and Venus. The Mir space station core module weighs only twenty tons; I will leave calculation of the obvious conclusion as an exercise to the reader. While NASA and the Air Force bicker over who will develop the Shuttle-C (for "cargo") or Advanced Launch System, the United States remains a decade or more from regaining this kind of lift capacity.

The second advantage, a permanent human presence in orbit, is even more important. The Soviets have now demonstrated a consecutive free-fall endurance of just less than a year, and a total single-cosmonaut endurance of about twice that. Their human spaceflight experience adds up to better than three times that of the United States. Nicholas Johnson told the Red Star 2000 conference that "a dozen cosmonauts have spent more than six months in space. Five cosmonauts have together spent more time in space than the entire [American] astronaut corps." By the time you read this, all of these figures

⁴The SSMEs operate right at the edge of the temperatures and pressures material structures can withstand, and thus may prove to be the United States's greatest technological achievement. The space shuttle is said to be considered just that by the Soviet Union, as well as one of the greatest military threats to themselves—in contrast to its rather maligned status in the west. However, SSME performance does not necessarily equal reliability.

will be substantially higher. Short of a politically improbable crash program, this kind of spaceflight experience will not be achieved in the west before the end of the century—at best—by which time the Soviets, of course, will have moved far beyond where they are now.

Johnson compared Mir to the United States's Skylab expendable space station of the early 1970s. He said the Mir complex—consisting of Mir itself, the Kvant astrophysical module, a Soyuz human transport, and a Progress automated fuel tanker and bulk transport—weighed about half of what Skylab did, with 40% of the interior volume. Mir, however, is still under construction. The total mass of the completed Mir will be around 130 metric tons, a little more than Skylab; the volume will still be slightly less. Two of the six new modules to be added to Mir will have two crew compartments each, which added to the two on the Mir core module, equals a total of six. This suggests the ultimate crew size contemplated. Johnson emphasized that Mir should be compared only to Skylab, not to NASA's Space Station. NASA's current station design represents a quantum jump in capability beyond both Skylab and Mir, and the Soviets are planning a similar leap for the 1990s.

Nonetheless, cosmonauts are in space right now. They repair and modify the interior of their space station almost daily, add extra solar panels outside, and solve major problems with equipment. On *Salyut-6* they undertook repair of dangerous propulsion systems. Cosmonauts worked within the literally frozen confines of a derelict *Salyut-7*,

restoring electricity and heat, mopping up the water, and bringing it back to life. This predecessor to Mir is currently in a high storage orbit, testing the long-term endurance of its systems, and will be revisited by a crew in 1989.

Cosmonauts practice construction techniques during many space walks; they are nearing the culmination of a decades-long project to learn how to conduct welding in space. No sooner has one emptied Progress tanker/resupply vessel left Mir, then another is launched to transfer fuel and oxygen to the station, also delivering food, water, and mail.

And so on. It all spells "experience," which is worth a thousand NASAesque leaps into the technological unknown. Given all of this experience, *are* the Soviets going to Mars?

The most recent and detailed Soviet statements on that subject were presented at an American Institute of Aeronautics and Astronautics Aerospace Engineering Conference in Los Angeles in 1988, and were reported by Andrew Lawler in the American journal *Soviet Aerospace*. Cosmonaut Vladimir Solov'yev reportedly said that a human mission to Mars would require some ten launches of *Energia* to place one thousand metric tons into orbit for a two- to three-year voyage.

"Design engineer" Victor Legostayev told Lawler that the Soviet's new civilian space agency, Glavcosmos, has already begun preliminary design of a Mars (transit) spacecraft, but has yet to decide between a three-axis stabilized design or one that spins for artificial gravity. (It is very interesting to note

that Soloveyev, the cosmonaut, apparently favors artificial gravity while Legostayev, the engineer, favors a simpler, non-spinning design!) Still more recent statements have strongly implied that the Soviets now plan to go with a spinning centrifuge. In any case, the ship will be built up of modules somewhat larger than Mir, and include elements for medicine, science, and habitation.

The crew would consist of ten to twelve "specialists," including at least one physician, and is to stay on the Martian surface for some thirty to sixty days. *Soviet Aerospace's* report was not entirely clear, but seemed to suggest the Soviets plan two different kinds of interplanetary transport, one for so-called "sprint" Apollo-class missions and one for long-stay infrastructure missions. This implies a *series* of missions, one kind for delivering cargo and another for human beings and their equipment, all leading to much more than the "simple" landing of Cosmonauts on the Martian deserts.

It seems evident, then, that the Soviets are consciously planning extensive human Mars exploration. But when this is to occur remains far from clear. Soviet statements amount to sometime soon after 2010.

Even if they wanted to, the Soviets could not send human beings to Mars tomorrow. In two decades of effort, the Soviets have demonstrated only one-third of the endurance required for a full-scale, three-year mission to Mars. Sprint missions can be done faster, but would leave cosmonauts on Mars for a month or less. It is unlikely the carefully-planned, almost plodding Soviet

effort will mortgage long-term ambitions simply to get there soon. Likewise, they are not obviously testing a trans-Mars transport in low Earth orbit, something that on the basis of past practice we might expect for a decade or more before using it for real.

The Soviet Union's biologically closed life-support project does not seem to be advancing particularly well—the Russians have admitted to repeated failures and only limited successes in growing plants on their stations. They are not giving up: One of the later modules for Mir will be a "space greenhouse," to practice producing food and oxygen from plants on orbit. The Soviets reportedly said on the Moscow World Service last year that one of the purposes of their biosatellites (launched about once every other year) is to "develop biological systems for future interplanetary spacecraft; such systems will keep cosmonauts supplied with fresh food during long-term flights." Nonetheless, while the Soviets have put far more effort into closed life-support than has the United States, the chief result of that has been to show how difficult even growing anything in space is, let alone creating closed biological systems.

Nicholas Johnson approached this issue from another angle during a recent lecture for the Students for the Exploration and Development of Space in Huntsville, Alabama. He said that the Soviet Union could not "send a Mir to Mars and expect to get it back in working order." *Salyuts-6* and *-7*, on which the Mir is based, functioned in Earth orbit long enough to get to Mars, but this was only possible through constant

delivery of spare parts from Earth on Progress transports. It took seven Progress' to support two cosmonauts in 1987. These would not be available on a trip to Mars, and extra-vehicular repairs would be more difficult and dangerous. Therefore, Johnson does not expect a Soviet human mission to Mars before the Russians have demonstrated much greater spacecraft reliability than they have to date.

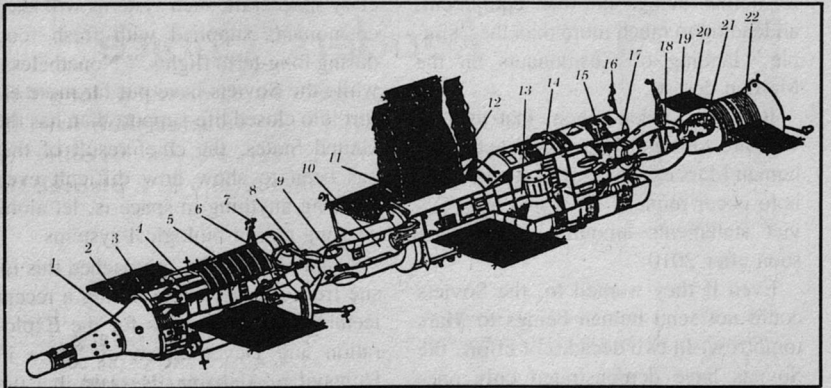
Johnson also does not foresee the Soviets conducting an early human flyby through the Martian system in preparation for Mars landings, an idea recently discussed in the west. With Apollo, the principal risks were taking off and landing; getting to Earth's moon was relatively straightforward. For Mars,

however, getting there would be much of the total danger, with landing and taking off a relatively small part of that. Johnson said, "I see no rational (reason) . . . to take 95% of the risk and come back with very little to show for it."

The general impression of the Soviet human space program, then, is of a very long term project pushing deliberately but relentlessly toward a specific goal. As a rough guess, based mostly on their orbital endurance and the approximate state of the closed biological life support programs, the Soviets at best might be somewhere between one-third and one-half of the technological way toward placing humans on Mars.

* * *

ORBITAL SPACE COMPLEX: COSMOS SPUTNIK-SHIP—SALYUT 7 STATION—SOYUZ TRANSPORT SHIP.



Cosmos sputnik-ship:

1. re-entry vehicle; 2. solar battery; 3. transfer tunnel; 4. fuel tank; 5. operational-service unit; 6. inner transfer hatch; 7. antenna of the radio-technical docking system; 8. docking unit.

Salyut 7 station:

9. hatch for going out to space; 10. transfer compartment; 11. additional solar battery; 12.

main solar battery; 13. working compartment; 14. research instruments compartment; 15. transfer module; 16. antenna of radio-technical docking; 17. engine compartment.

Soyuz transport ship:

18. living compartment; 19. hatch for transfer to living compartment; 20. solar battery; 21. descent capsule; 22. instrument compartment.

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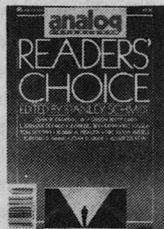
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So why start the automated reconnaissance of Mars now? As we will discuss below, the Soviets plan *far* into the future, and human Mars missions, while not likely to happen immediately, are certainly very much on their minds.

We in the West tend to misinterpret as direct military preparations Soviet willingness to undertake science more or less for its own sake. The Soviets support vast projects in nuclear physics, nuclear fusion, biology, space science (on Venus!), and other fields that are not likely to have any immediate application. The scientific method is an important part of Marxist philosophy; Marxism, after all, started out as an attempt to come up with a scientifically rigorous explanation of the workings of history and economics. Whatever the failures of Marxism as a science, the impact of its scientific origins on the Soviet world view should not be underestimated. Marxism (read "science in the Soviet world view") fulfills many of the same needs in Soviet culture that organized belief in the Christian God has in the West. Spaceflight is the ultimate achievement of the Soviet "religion" of science, the one activity where they have clearly succeeded better than anyone else—and may therefore be supported largely without question.

Why go to Mars at all? Alien though it is, Mars is the most Earth-like extraterrestrial world in the Solar System. It has more-or-less accessible water under the surface—and perhaps more importantly, in orbit, locked up in the rocks of Phobos and Deimos. Water, electrically split into hydrogen and oxygen, becomes rocket fuel, air, and chemi-

cally stored electricity. Planetary scientist Bruce Cordell has pointed out that Mars is the only extraterrestrial body in the inner Solar System where water-concentrated ores (the principal source of ores on Earth) are possible.

Where else can the Russians go? Earth's Moon has been done. The surface of Venus cannot be colonized or even visited by humans with any foreseeable technology. Mercury is possible, but is almost as difficult to get to as the Jupiter system. Jupiter, a long and therefore dangerous flight from the inner Solar System, has intense radiation belts that put the most interesting worlds in that system more or less out of reach; the next world after Mars, the asteroids, and possibly Callisto, may well be in the Saturn system.

Asteroid mining and "space colonies" will be all-important for the development of the Solar System, but who wants to live there? On Earth, the trend in developed countries is out of the overly-artificial city cores and into the relative "wilderness" of the suburbs (thereby ruining the wilderness for everyone, but that's another article). Given their choices, the colonists—as opposed to "workers" who may of necessity camp in orbit—may want to live on planetary surfaces, as close to a recognizable wilderness as possible. The Soviets are discovering on Mir, and its Salyut predecessors, that long-term spaceflight in a completely artificial environment is a difficult and uncomfortable proposition, not to be undertaken lightly. On Mars, the wilderness is palpably *there*, just on the other side of that window. You can step out the door and

physically explore a recognizable and distinctly non-artificial landscape.

Mars is a grand desert wilderness, with a surface area as great as all the land on Earth, beautiful and untouched, with canyons and volcanos more spectacular than any to be found back home. It is an unexplored frontier easily understood to a species that explored its way out of Africa. This aspect appeals to the Russian mind as strongly as it does to the American. Soviet writings on spaceflight show, buried beneath their nearly unreadable bureaucratic style, an intense romanticism that puts Western science fiction writers to shame.

There is one final reason for Soviet planetary exploration, one often overlooked in the west, but probably the most important of all to the Soviets themselves. That is, of all things, international cooperation. The Phobos project is the most international mission ever undertaken. In addition to the Soviet Union, Bulgaria, Hungary, the German Democratic Republic, Poland, Czechoslovakia, Austria, the Federal Republic of Germany, Sweden, the European Space Agency, and France, at least indirectly even the United States and Britain are participating.

Why should the Soviet Union cooperate with anyone in space? At least in human spaceflight they are the dominant spacefaring power on Earth and are likely to maintain that position into the indefinite future. So what's in it for them?

The Soviet Union is a state that believes in the ability of technology to solve problems. No matter how good at it we get, we in the West are always

a little uncomfortable with our technology. Not so the rulers of the Soviet Union, although that is slowly beginning to change as technological disasters accumulate. As Jacob Kipp, Senior Military Analyst for the Soviet Army Studies Office at Fort Leavenworth, Kansas, put it at the Red Star 2000 Conference: "The future is a subject that is not left to chance in the Soviet Union." The USSR *plans* its future in a way unheard of in the West. But Kipp told me the Soviets see it as more than simply planning, they *struggle* for their future; they try to *create* it. According to Kipp, "foresight" is considered by the Soviets the most important characteristic of military commanders.

It may be observed that the Soviet Union has not been terribly successful at planning its future. Much as the Pentagon would have us believe otherwise, so far the Soviet Union has manifestly failed in its ambition to dominate the world, either militarily or culturally. It is the United States that inherited from the British control of the world's oceans. The youth of the world wear blue jeans and listen to rock music, not Cossack blouses and balalaikas.

I would argue that this failure to predict the future is no real surprise. History is too complex to be predictable, at least for the time being. Further, the Soviets began their predicting exercise with the pre-conceived notion that their band of communism would prevail. Preconceptions have no place in other sciences, why should they in a predictive history? The essence of Marxism, however, is that all of this is not true, that the economic forces that drive history

are predictable, and what is more, can be manipulated.

Nonetheless, in addition to the Red Army, there are two fields of endeavor where the Soviet Union is a world-class nation. One is sub-atomic physics, especially as applicable to nuclear fusion, and the other is spaceflight. These two should sound familiar—remember Westwood's belief that these are the two fields in which the Soviet Union *planned* to excel. Since they are sciences dependent on large-scale engineering, they are inherently amenable to long-term, monolithic planning—opposed to, say, computer research which is far more dependent on breakthroughs by individual researchers.

The Soviets plan their future. What is spaceflight if not the future? The Russians have said it themselves: "The nation that controls space controls the world." More to the point might be: The nation that controls space controls space. For it is space where any future resources must be found once Earth is eventually, inevitably, exhausted of whatever resource you care to name. The Soviet Union's leaders know this. They may be planning that far ahead. We, in the West, are not.

This brings us back to the question of cooperation. The Soviet Union may believe that the nation that leads the thrust into space will be the nation that leads the cultural development of the future. We can see this happening even now. With the Western launch capacity only just beginning to recover from three years of disaster, and that with reduced capacity at much greater cost than was planned before the loss of

Challenger, Western scientists are increasingly looking to the Soviet Union for access to space. It is only a matter of time until capitalists do the same—and the State Department and Pentagon, in a hopeless effort to keep Western technology out of Soviet hands, cannot stop them forever. This is not trivial. Those scientists with access to the new frontier are the ones who will make the grand new discoveries of the future; discoveries that will eventually lead to invention; and that, in time, to new industries.

Thus, I fear that, because of its very international character, the Phobos mission could be the final blow to United States's leadership in planetary exploration. The other nations of the world have watched the United States systematically dismantle its planetary program, renege on expensive agreements with the Europeans, and refuse to negotiate a fair or even reasonable contract on the division of Space Station responsibilities and costs. They may soon give up on the United States entirely.

While perhaps not actively planned for, I believe the Soviet Union has understood something like this all along. *Challenger* and the other launch vehicle losses gave them the chance, almost through default, to gain the dominant position in the global thrust toward space. Glavcosmos saw that chance and moved, offering dirt-cheap access to orbit.

The answer to this peaceful challenge—and I do emphasize that it is peaceful; it is inherently economic and only secondarily military—is *not*, as the State Department would have us do, to outlaw international launch agreements

with the Soviet Union. Ruling that American spacecraft components cannot be launched on Soviet vehicles, when those are the cheapest (or only) way to orbit, will only stop other nations from buying American technology for their satellites.

If we in the West choose to lead (or even seriously compete) in the development of space, the relative freedom of thought and action available here should give us an unbeatable edge in the technology of spaceflight. More importantly, it should encourage the world's best scientists and engineers to work in our space programs. It all comes down to blue jeans and rock music: Do we want the spacefaring civilizations of the future to emulate our culture, our institutions of relative respect for information and the individual? Or do we want future cultures to derive from the ancient authoritarian drives of the Soviet Union?

The answers, I believe, are "both" and "neither." Our best hope for col-

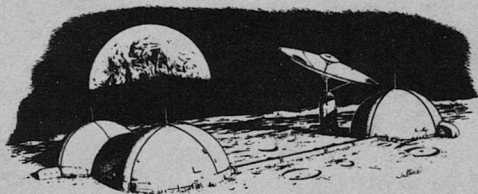
onizing the inner Solar System is for as wide a sample of human cultures as possible to have access to space. That will allow for the greatest range of cultural experimentation—something we will desperately need. The Solar System as a whole is the most alien environment humanity has ever tackled, and I believe that nobody yet realizes how difficult colonizing that environment will be.

We will not get that cultural diversity if either Superpower dominates access to space. By competing *and* cooperating with the Soviet Union, the west might hope to lead all of humanity into this new arena for the human drama, and do it as a family. A family with its squabbles, its rich and poor, its members that periodically disappear to sulk in a corner or foment discontent among their siblings . . . but a family that has finally learned to live together while maintaining at least a part of each member culture's most favored institutions.

That, after all, is what civilization is all about, is it not? ■

About the Author

Donald Robertson is a freelance journalist specializing in spaceflight and space science. He covers the West Coast for a number of European journals and one American one. His training, oddly enough, is in archaeology and in that capacity he has helped to separate a Roman sewer from an Israeli desert. Parts of the article you have just read are adapted from a book on Soviet planetary exploration Donald is currently writing.





**ON
THE
WINGS
OF A
BUTTERFLY**

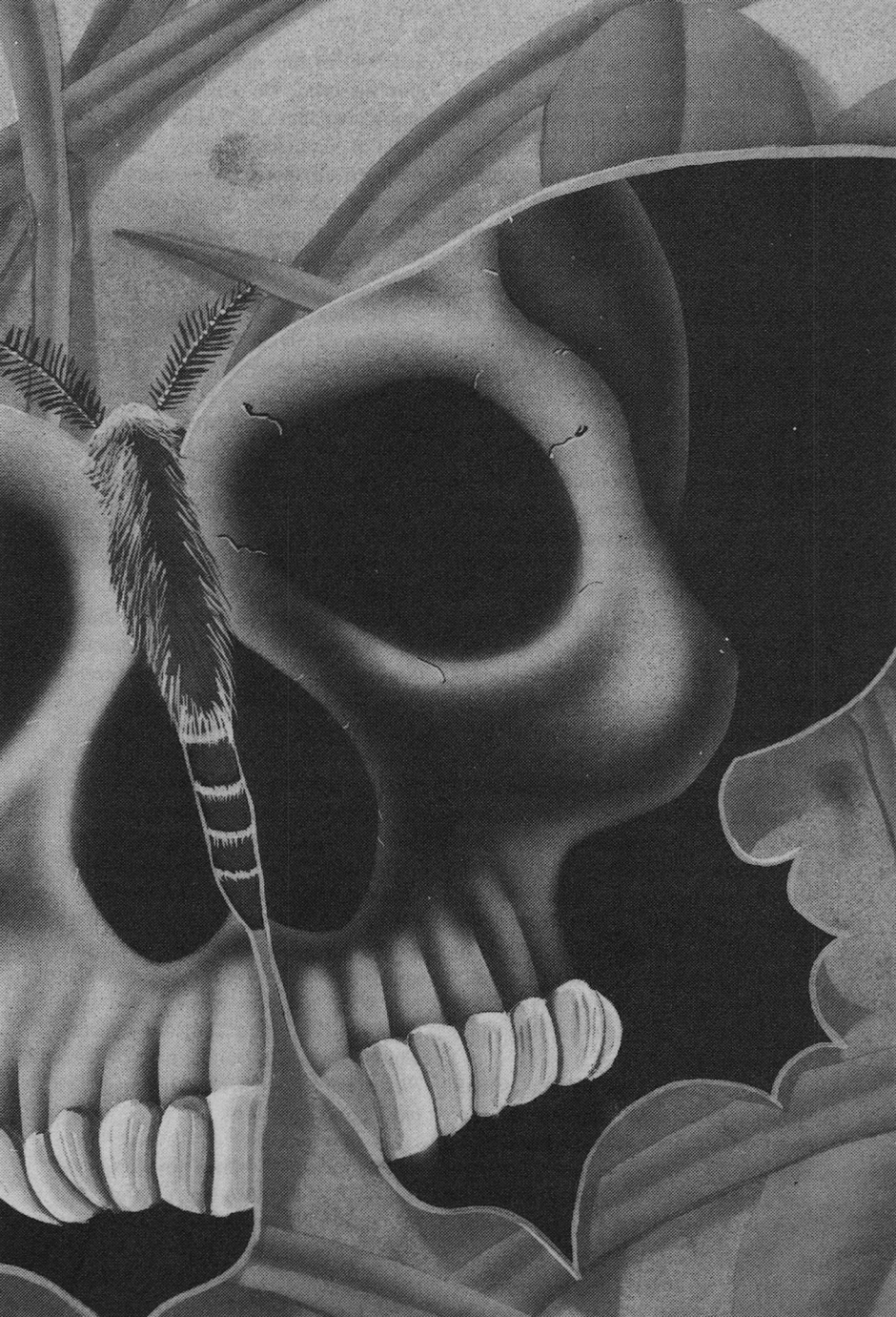
Michael F. Flynn

Sometimes a very small
push can have very
large effects. But
such a push
must be
applied very
carefully . . .

Martin Cameron



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The ship sailed into the Gulf of Guayaquil under a cloud of canvas and dropped anchor off the town of Tumbéz. All the people of the town gathered on the beach to stare at the strange floating castle and to jabber excitedly to one another concerning who (or what) might live in it. Manco chose a vantage point for himself on the dunes so he could watch everything that took place. He shaded his eyes with his hand and peered at the vessel. Sailors danced in the yards, shrouding the sails. Gulls shrieked overhead. He saw a boat throw off its tow line.

So, it begins, he thought.

The mayor of the town scrambled toward the fore of the crowd, hastily tying on his fringe of office. A visiting Inca followed him languidly, no doubt amused by all the provincial hubbub. The Inca, Manco knew, was Someone's Younger Son, sent off to visit the Lowlands, either to keep an eye on the local *curacas* or—what Manco thought more likely—to get him out of the parental hair. He led a pair of tame cats—a puma and a jaguar—on light golden chains, and was trying his best to look bored and unimpressed. But the biggest sailboats he had ever seen before were reed *balsas* on the shores of Lake Cuzco, and the caravel off the coast challenged even his aplomb. Manco waited patiently while the ship's boat rowed in. After waiting so long, what did a few more minutes matter?

The man who finally stepped ashore, Manco learned later, was the gunner, Pedro de Candia, which meant "Pete the Greek." He was a large man, of imposing stature, and wore sheets of black iron on his chest and limbs; and

a helmet of the same strange material atop his head. He was a man of such impressive physique that he would have evoked comment wherever he went. And, indeed, there was much discussion over his size. What shocked the crowd, though, and made them murmur and point was his face, which was white and hairy.

The Inca forgot to be unimpressed. He dropped his leashes in surprise and the cats, suddenly loosened, bounded toward the stranger. The crowd cried out in warning, and Manco could see the men lining the gunwales of the caravel also pointing and shouting. The Greek turned and saw the cats racing across the sand and crossed himself, right to left. Manco watched silently, with his arms folded.

The tame cats leapt upon the Greek, nearly toppling him with their momentum. They licked his face and nuzzled him. "Hey, hey!" Manco heard the surprised gunner say in his badly accented Spanish. "You cats like the Greek, no? Yes, you good omen. Hey?" He turned and waved to the ship off shore. "Is all right, *amigos!* They is friendly here!"

"For now," he added more softly as he turned to pet the jaguar.

Manco, watching from his vantage point, rubbed his hands together nervously. *Now, he'll go back to the ship and bring his capo.* Manco looked out at the ship and caught sight of a robust, white-haired man leaning over the rail. *Pizarro,* he thought. *That would be the one they call Pizarro.*

The folk of Tumbéz loved a good spectacle and Manco had to admit that the Spaniards put on quite a show.

Swords flashed, and multi-colored banners flapped in the sea breeze. The white-faced men knelt in the sands of Guayaquil and sang. It was a display the like of which the town had never seen before. Manco wondered how the admiring audience would react had they understood the words the Spaniards were using. *We claim these lands* . . . Most of them would not care, Manco decided. Why should they? What was one cruel and distant lord compared to another? But, the young Inca would hardly be amused to learn that they were claiming *Tavantinsuyu* for their absentee king.

Not that the Child of the Sun and his *coya* queen even set foot in the Lowlands, either.

Manco watched the young noble as he stood there surrounded by the Iron Hats, grinning foolishly like the younger son he was, while the strangers talked gibberish to him and fingered his golden ornaments and traded significant glances with one another.

Manco decided it was time for him to intervene.

He walked toward the two older men. They were deep in conversation with each other, gesticulating and scowling. Both of them were white haired, well into their fifties; but robust and full of pent-up energies. There was an aura of power around them both. Something that other men sensed and gave heed to. But there the similarity ended. As Manco came closer, one of their henchmen shouted something and they turned to watch him.

The one on the right, Manco saw, was missing an eye. He was small of stature and about as ugly a man as

Manco had ever seen. Yet, his cheeks were full and there were laughter lines at the corners of his mouth and eyes. He folded his arms across his chest and fixed Manco with a stare. "I wonder what this one wants," he told his companion.

"Probably wants to rub our skin to see if the paint comes off," the taller man answered, and they both laughed. The tall man was solidly built, big-framed, with a set to his jaw and an unblinking stare. There were no laugh lines on his face, but other lines, as though he bore the weight of the world upon himself, and knew it. There was something hard and cruel about his mouth.

Manco bowed low from the waist, courtier-style, and swept his arm out gracefully. "Have I the honor," he said in Spanish, "of addressing the *Adelantado* Francisco Pizarro?"

The two exchanged surprised looks. "You speak our language," said the short, ugly one.

Manco turned his bow toward him. "Allow this poor one to introduce himself. I am Manco Sanchez. My father was a shipwrecked Spanish sailor cast ashore near here many years ago. He married an Indio woman, but he raised me to be Spanish like himself. I knew that someday you would come, and I have waited many years for this. When I heard that your ship was nearing these waters, I hastened to Tumbes to offer my services."

"Tumbes," repeated the tall one. "Is that the name of this sty?" He seemed almost surprised that such a place would have a name. "Well-met, señor. I am Francisco Pizarro," he con-

tinued, "though I am no Adelantado. At least, not yet." He laughed and his companion shot him a covert glance. "I am but a poor explorer. This is my partner, Diego de Almagro."

Manco bowed again to the one-eyed man. So this was "Almagro Jake," a man whose strength and endurance were legendary. He could, it was said, out-walk even an Indio through the mountains and jungles, and battle with swords at the end of it. And still have the energy to carouse the night away.

"Save that bowing and scraping," said Almagro Jake, "for the Madonna-forsaken dons. We are all equals here." Manco noticed how his glance flicked again toward Pizarro as he said that. Almagro grasped Manco's arm and squeezed it vigorously.

"We will have great need of an interpreter here," said Pizarro. "You do speak the heathen gibberish, don't you?"

Manco smiled and said something polite in Quechua and, just to show his versatility, followed it with a sentence in Aymaru. He doubted that the Spaniards would know the difference; or even that there was a difference. Like the Greco-Latin Empire of legend, the Inca realm spoke in two tongues.

Almagro laughed and nudged Pizarro with his elbow. "There! You see! This is what we need. He is just like that Doña Marino bitch that Cortez found up Mexico way, though not so pretty."

Manco thought that this squat, ugly man would be the last one to judge another's beauty, but he held his peace, not wishing to offend his new patrons. He wondered if they believed his story about the shipwreck.

"Perhaps," said Pizarro. He was a

severe man, not much given to smiles. Years of privation had left their marks on his face. The look he gave Manco was so full of weariness that for a moment Manco felt pity well up inside himself. "I would not condemn a good Christian to live one more day than necessary in this squalor," Pizarro said. "We will have need of an interpreter when we return here, and you may join our company if you wish it. But for now, we return to Darien."

"Don't be a fool, Diego," said Almagro, and Manco had the sense that he was resuming an earlier, interrupted argument. "Look at the gold on that young dandy over there! And this is just a provincial town, not worth two bites of a Spanish Thaler. I tell you, El Hombre Dorado, the Golden Man, must live near here somewhere. If we return to Panama now, with this news, 'Pedro the Joustier' will seize our ship and send his own lackeys here to take the wealth."

"Governor Pedr'arias sold us back his share . . ."

"Don Pedro Arias de Avila," said Almagro firmly, "is a grasping, conniving, traitorous man. Believe me, I know many such men." He laughed aloud. "Why, I am one myself; and you as well." Manco noticed a strange look cross Pizarro's face at that, but it was gone in an instant.

"When you left me on Gallo Island," Pizarro reminded him, "you said it was because we had not the numbers to strike inland. Look about you!" He waved an arm wide. "Have we the numbers now? No, we are fewer, yet, what with the losses and desertions. For what did we wait, there on Gorgona, I and my thirteen comrades, amid the cease-

less rains and pestilent mosquitos; starving, because there was no food on that forsaken isle? We endured, because we knew you would be returning with the reinforcements." Pizarro turned to Manco. "And when he came—" Manco knew the words were addressed to Almagro and not to him. "And when he came, he brought but the one ship and crew and no additional men. Why must I endure the hardships alone, while he sails back and forth to Darien at his leisure?"

"Pest!" Almagro's face flushed. "Do you know why I brought no men with me, Francisco? Do you know why? Because no one would come with me; that is why! Because they laugh at us in Darien! What point is there in going back? Father Fernando can raise no more money. Fernando de Luque! The townfolk, they call him 'de Loco.' We have sailed south now how many times? And we lose men and and we lose ships and we lose money and always we return with nothing. By Our Lady, I will return with *something* this time!" He crossed his arms and dared Pizarro to disagree.

Manco thought it best to say something; before Pizarro and Almagro could have a falling out. If they argued, they would simply loot Tumbes and return to Darien, and Manco did not want that.

"Indeed, Señor Almagro speaks truth," he said. "When you return, you must return with gold dripping from your pockets, not with the few baubles and trinkets you see here. Then you will have all the volunteers you need." Manco saw how their eyes lit at the mention of the gold. If Manco could call what they saw about them "a few bau-

bles," what might await them elsewhere? Pizarro licked his lips in a quick gesture. He glanced at the town, at the Inca, at the ship, at the mountain.

"We have not the men and arms to capture an empire," he said doubtfully.

"At this juncture, my captains, you may not need them. Now is the time to strike into the mountains. Without delay."

"Without delay." Pizarro looked at him with an icy stare. "And why is that, Sanchez?"

Manco swallowed. "They say that the Child of the Sun has died and that his two sons are fighting over his realm. My Lords, the Inca domain is vast, far vaster than you may imagine and its armies are numberless. Even a large expedition might be overwhelmed by sheer numbers. But all commands originate with the Child of the Sun. Capture him and you have captured the empire. At this juncture, a bold man might seize the initiative and rule them all. Delay, and the opportunity may be lost."

Pizarro ran his fingers through his beard. He looked at Almagro. "A civil war, you say? How old is this news?"

"The great Huayana Capac was alive no more than a month ago." That was certainly the case. The stones of Quito still smoked from the fighting.

"And how bitter is the conflict between the two brothers?"

"To the death. They hate each other. Huascar and Atahualpa are but half-brothers. The one is legitimate; the other, illegitimate."

Almagro grinned. "I like the sound of this, Francisco. Did not Don Cortez say he owed his victory as much to Machiavelli as to cannon? Divide and

rule. The Indios are like little boys at such games.”

Little boys. Manco remembered how, when Huayana Capac put down the revolt of the Carangues, he had beheaded all of the men of fighting age and had thrown their bodies into the lake, declaring, “Now you are all boys.” A ruthless man, perhaps as ruthless as Pizarro; and not to be trifled with. Atahualpa was not yet of the same stamp.

Pizarro stared out at the ship, where it lay upon the water. He pulled upon his beard. “Which brother is the more skilled with arms, would you say, Sanchez?”

“Atahualpa, without a doubt. His father made him viceroy of Quito, which is here in the north, because the Empire of Quito was but recently conquered. The Chimu folk are restless under the Inca yoke and need a firm hand over them.”

“And which is he? Atahualpa. The legitimate heir?”

“No, he is the bastard.”

Pizarro laughed. It wasn't coarse and hearty like Almagro's laugh. It was a cracked and nasty laugh. It snapped out once, twice, like a whip; then it was gone. “Then I suppose we must aid him. This Atahualpa.”

“Certes,” said Almagro. “We bastards have to stick together.”

The climb up the western slope of the Andes was a long and arduous one. Manco had scouted routes over the past year preparing for this day; and there were Inca roads and bridges and *tambos* along the way. Even so, it was a difficult journey. The conquistadors had taken off all their armor save their helmets and

their breast-and-backs, stowing the gear in the packs tied to their mules. Pizarro had given Manco the use of a horse and put him on the point to guide them.

“Mother of God!” said Sebastian de Benalcazár when they breasted the Ecuadorian foothills and first caught sight of the snow-capped peaks of the cordillera. “Those passes are higher than Alpine peaks!”

The others paused in their weary march to stare at the vista. Peak piled upon peak toward the distant sky. A wall, vast and mighty, crowned in snow and ice that sparkled a russet color. “We have as far to climb as we have already climbed,” said Almagro Jake and he looked at Manco when he said it.

Manco shrugged. “If that Inca boy in Túmbez can make the trip, it is surely no great feat for such men as ourselves.”

“That boy was strangely built,” mused Pizarro. “His chest seemed bigger than it should have been for a man his size.”

“Small wonder,” wheezed Pedro de Candia, the gunner. “It is to breathe enough of this thin air.” They all laughed. It was true enough. All of them were panting hard and felt light-headed. Except Manco, of course.

“The Empire of the Great Sun,” said Manco, pointing to the shining peaks, “lies in the mountain valleys between that range and the next. The Inca rules the coast as well, but all the wealth and riches are in the mountains.” He stared at the mountains. *Tavantinsuyu*. The Four Quarters of the World. Such a vast world; and yet grown now so tiny. The world had more quarters than even the

Inca could imagine. "There is gold there. More gold than you can carry."

Pizarro leaned over his horse's neck. "What are those mountains called, Sanchez?"

"Andes," Manco answered. "The Copper Mountains."

"Copper," said Pizarro stroking his horse's mane. "No, they are the Golden Mountains."

"El Hombre Dorado," whispered Benalcazár.

They resumed their march, with Manco in the lead. Almagro quickened his step and fell in beside him. "I will believe in this El Dorado when I see him," he said, jerking a thumb at Benalcazár. "Always the Indios tell us he lives somewhere else. Not here, Great Lord, but way over there." He laughed. "As I would say myself were I them."

Manco looked at him. "I thought you believed in him yourself, this El Dorado."

Almagro shrugged and squinted at the distant mountains. "I believe in looking for him."

"There really is a Golden Man," Manco told him. "And he really does live somewhere else and not in Tavantinsuyu."

Almagro laughed and Manco shrugged. "He was a king of the Chibchas, a people who live in great cities on a plateau to the north. They say that in ancient times, the king killed his wife for adultery and threw her body in the lake. Ever since then, at a certain time each year, the king is covered with gum and then dusted with gold. Then he rows to the middle of the lake and washes the gold off as an offering to the dead queen."

Almagro looked at him. "All that gold, washed into the lake?" He shook his head, not believing such ignorance possible.

They walked their horses a while longer in silence, Manco watching the Spaniard for evidence of fatigue. He could see no sign of it. After awhile, he said casually, "It is a wonderful thing how we have all come here together into these mountains, don Almagro."

Almagro spat on the road. "I am no don. And there is little enough to wonder at. You are here because your father was shipwrecked. I came here because there was no other place to go." He said nothing after that and Manco wondered if he would answer. Then he grunted and laughed. "But we are all New Men here, you know. Why, I could style myself 'don' if I'd a mind to, and who would call me out? Even the poorest and most ignorant peasant lad can become an *encomendero* with vast estates. Francisco and Fernando and I, we have a thriving partnership back in Darien. Mines and farms. We are *vecinos*. What would we be in España, any of us? Nothing. Less than nothing. I left the village of Almagro because it was nothing. I could stand that numbing peasant labor no longer. So, I ran off and became a servant to one of the chief magistrates at the Alhambra. Then . . ." He spat again. "Then I was in a fight. A tavern brawl. Over a woman, or over a bet, or over nothing. What does it matter now? I had my knife and he had his, but I knew better how to use it. Now I am here."

"But why not stay in Darien with your mines and farms? Why come to

these mountains to sweat and bleed? What more do you want?"

"What more do I want? I want . . ."

He paused and looked again at the peaks above. A condor circled in the air above them and Almagro watched its arrogant flight until, with a screech, it banked away and vanished. "I want El Dorado," he whispered.

Manco called a halt when they reached the next *tambo*. This was a small rest-stop, with only a single building and a storehouse, since the road they were traveling was only a feeder road from the Lowlands. The *tambos* were spaced every ten to twelve miles and contained provisions for travelers. Some of them, on the main roads on the High Plateau, were quite large.

The *chasqui* who was waiting inside looked surprised when he saw Manco enter with his party. While the rest stops were in theory for everyone in the Empire, few folks traveled, except on official business. The runner's eyes bugged when he saw the white men and he looked to Manco for an explanation.

"What did you tell him?" Pizarro demanded after he had finished.

"Only that you are foreign lords coming to pay your respects to the Child of the Sun."

"Gold is the Child of the Sun," said Pizarro. "With gold, a man is wealthy and has the respect of his community. Without it, he is nothing. A chattel of the dons. Oh, yes, Sanchez, I am coming to pay my respects."

Manco did not tell him that the Incas called gold, "The Tears of the Sun."

The runner was busily tying knots in his *quipu*. It was a form of writing so

different from what the Spaniards were used to that they did not even realize that the runner was making notes on their numbers and strength. Manco told the runner that the men also had *horses*. That these were beasts like giant llamas that men could ride. And that they possessed weapons made of the black metal, including a kind of sling called a *musket* that threw shots with great noise and speed. The man's face told Manco that he believed only half of what he was telling him, so Manco told him to go outside and see the horses for himself. The runner demanded to know by what authority he gave orders to a *chasqui* and Manco exposed the fringe he was wearing beneath his *poncho*.

The runner's face went pale and he bowed and ducked out of the building.

"What was that all about?" asked Almagro.

"I told him of your horses, and he didn't believe me."

"Who is he, the innkeeper?"

"No. There is no innkeeper at small stations like this one."

"No innkeeper? The one who prevents the peasants from running off with the provisions stocked here?"

Manco shrugged. "No one steals in Tavantinsuyu."

"What? Nonsense." Almagro plainly did not believe him and Manco was not disposed to argue. That valuable goods could be left unguarded was such an alien concept that it was easier to reject it out of hand. The Incas knew quite well that disaffection was rooted in poverty and idleness, so they took measures to assure that both were eradicated. No Indian, however low his station, ever lacked for food or clothing issued him

by the government. Thus, there was no reason to steal.

“If not the innkeeper, then who?” That was Pizarro, who had come up behind them while they talked. Manco looked him in the face. Pizarro wanted to know everything, because who knew on what detail his survival might depend? He wanted to know how the Empire was put together so that he could take it apart and rebuild it closer to his own heart’s desire.

“A royal messenger. *Chasqui*, they are called. You can tell from his uniform.”

“Uniform?” interjected Almagro. “All these heathen costumes look alike to me.”

Fortunately so, Manco mused. “The runners carry messages along the roads,” he continued. “In fact, the roads were built for that purpose. Each runner goes from one way-station to the next—about ten miles—and hands the message on to the next runner.”

“Message? Have they writing, then?”

“No. The message is memorized.”

Pizarro stroked his beard speculatively. “That will limit the complexity of their messages then.”

Manco would have said something, but the sound of running feet drew them to the doorway. Pizarro looked out into the evening dark. “Who is it?” Manco came up behind him.

“Another runner,” he said, looking over Pizarro’s shoulder.

He saw the new man hand his quipu over. The two runners conversed quickly and lowly, with quick glances toward the building. Then the man who had been in the way-station sprinted up the road toward the next tambo. The second

man walked slowly to the building. He held a conch shell in his hand that he used as a horn.

When he came to the doorway he stopped and waited for Pizarro to get out of his way. It was expected. Everyone made way for the emperor’s runners.

Pizarro looked him up and down slowly, then moved back a step and let the man inside. Then he returned to the doorway and watched the departing runner.

“The first man is going up the trail, toward the mountains,” he observed. “This one must have come up from the coast, then.”

“From the coast, eh?” said the Greek from the fire where the others were gathered. “I think word of our comings go before us, hey?” The Spaniards looked at one another and began to mutter.

Pizarro turned. “And what of it?” he demanded. “What if this whole Madonna-forsaken Empire knows of our coming? Don Cortez had little more than we when he toppled the Aztecs.”

That seemed to cheer them somewhat. “Aye, we have the horses and muskets,” said Benalcazár, “and they do not.”

Pizarro smiled. “No, Sebastian. If it comes to combat, our guns and horses will make little difference. There are only a score of us. In a battle, could we reload before the fighting closed hand-to-hand?” He waved an arm in dismissal. “How much impact would twenty shots have in a battle involving thousands? And our horses? Did the Aztecs remain long frightened of them? No, my friends . . .” He slapped the hilt of his sword. “It is not our technology that

gives us the edge. It is this!" And he tapped his skull.

Benalcazár glanced at his companions and grunted. "If brains are to be our weapons, I would wish ourselves better armed."

The next day they came to a chasm spanned by a rope bridge. The conquistadors looked nervously over the edge. Far below, a wild stream smashed itself against rocks. Manco estimated the drop at 300 meters. The rope bridge swayed in the wind that hummed in the cañon below. The cables were woven of maguey fibers into bundles as thick as a man's body. The footing was a macramé of rope and wooden planks.

"We are to cross that?" asked Benalcazár. His face was white and his throat worked convulsively.

"How did they throw the bridge across? That's what I'd like to know." That was Bartolomé Ruiz, the navigator. He was studying the construction of the bridge closely, running his hands along the coarse ropes, probing the knots with his fingers.

"What of the horses, Francisco?" Almagro asked gravely from the edge of the precipice.

"Blindfold them and lead them," Pizarro decided. "So they won't panic."

Manco had crossed such bridges many times, but even he was still careful not to look down when he did so. He warned the others that their weight in the middle of the bridge would make it stretch and sag, but that this was normal. Benalcazár laughed nervously.

"Who will be first across?" he asked.

They all looked at Pizarro, who twisted his mouth in a wry grin. "The

price of leadership," Manco heard him mutter.

Carefully, Pizarro tied blinders onto his horse so it could only look straight ahead. The horse was nervous and stamped its hooves, blowing out its breath. Pizarro spoke soothingly to it and stroked its muzzle.

"A wrong step here could spell your doom," he told the others across his horse's neck. "But when in our misbegotten lives has that not been so? Whether crossing the sea or—" He laughed. "—crossing Pedr'arias. Next to that risk, this bridge is child's play.

When he was ready, he led his horse out upon the rope bridge. He walked gingerly at first, until he had gotten the feel of it, then he stepped more confidently. "It is sturdier than it looks," he called back. He coaxed his horse along, talking all the while, keeping the animal's attention fixed firmly on himself.

Manco glanced at where the others stood. Almagro squatted on his haunches, watching Pizarro intently, rubbing one big-knuckled hand in the other. When Pizarro was safely across, Almagro let his breath out and closed his eyes. His lips moved silently. His right hand flicked quickly, almost furtively, making a cross on his chest, and he kissed his fingertips. Then he rose and began bawling at the others to line up and move across one at a time.

What a strange friendship, Manco thought. Two men so unlike; yet so loyal to each other. He thought of their quarrels and what the future might hold for them both. *I'm doing the right thing*, he assured himself, and not for the first time.

* * *

That night they camped in another tambo. They were higher up the mountains now and the air was crisp and cold. Their breaths came in white cotton clouds as they huddled close around the fires. Not far, Manco assured them, slapping his arms around his chest. Tomorrow we'll be through the pass. A few days more and we'll be in the high valley of Quito.

He left them trading stories of El Dorado and walked out into the night. The breeze was chill and brisk and Manco wrapped his cloak more tightly around his shoulders. He wandered away from the tambo until he found a large boulder; then he perched himself upon it facing the pass.

The snow-lined peaks glittered in the evening sunlight. Condors floated lazily near the summits, seeking their nests. He thought about what lay on the other side. About all his preparations and what he was doing to Tavantinsuyu by bringing the Spaniard into the mountains.

It is better this way, he thought. The Incas had brought unity and prosperity to the high country. Famine, so common elsewhere, was unknown here. The Inca looked on his subjects as a kind father on his children. In the compulsory public labor, no one was assigned tasks beyond his ability. The laws were carefully directed toward the health and preservation of the people. The divine Inca would not permit his children to be miserable.

Yet, the realm must be destroyed.

Every benefit the people had—and they had many, compared to the Spaniards—they had as a grant from the government, not as a right. There was no

such concept as private property. They could not engage in any work or amusement, except as provided by law. They could not change their residence or their costume without a license. Even their own husbands and wives were assigned to them by the government.

If the Inca would not allow them to be miserable, neither would he allow them to be happy, except as he permitted.

The realm was brittle. The least disturbance would shatter it. Individual initiative was stifled. Nothing happened except at the Inca's will. If the Inca decided, the Empire acted. If the Inca hesitated, the entire cordillera, from Quito to the Atacama, would be paralyzed with uncertainty. The realm lacked vitality; its people were frozen in a timeless stasis. The Spaniards would end all that—that top-heavy, frozen brittleness. They would bring vitality and initiative and change, along with their rough and greedy ways. The conquistadors were brutal, granted; but no less so than Huayana Capac or Tupac Yupanqui had been. They were cruel, but the Inca laws were cruel as well. Their families would rule as aristocrats; but were the Inca *allyus* any less aristocratic? The difference was the difference between lords who ruled with an iron rod, and lords who ruled with a copper one. If anything, the Spanish state was more loosely organized than the Inca state. And that was crucial: when things were loose, movement was possible.

At least, so he had told himself.

He realized that he was trying to justify his plans to himself. Manco had known when he had started on his task, that uncounted men, women, and chil-

dren would be deprived of life because of him. *It must be worth it. It must.* He had prayed—to Christ, to Viracocha, to anyone who would listen—for assurance; and had gotten no answer that would comfort him. The eyes of the unborn watched him in his dreams. Yet, the stifling hold of the totalitarian Inca state must be cracked; and the Spaniards were his hammer. Only, it must be just the right blow, delivered in just the right way.

He realized that he was more afraid of striking badly than of not striking at all.

A foot brushed the gravel behind him and he turned to see Pizarro standing there, his hands clasped tightly behind his back and his grey-marbled beard thrust forward. He looked older than he had at any time since Manco had joined him.

“That is a sight for the poets, eh, Sanchez?” he said nodding toward the glowing peaks. “Many a minstrel in Seville would give his life for such a vista.”

Manco said nothing, waiting for Pizarro to say what he had come to say.

“These Inca warriors, how do they fight? Do they fight like the Aztecs?”

Pizarro had told him about Cortez and the Aztecs. Manco thought about it, then shook his head. “They are not such hard fighters as the Aztecs, but they are better. They are soldiers, not warriors. The Aztecs fought as a mob; but the Inca’s soldiers are disciplined. They fight in ranks. Each tribe has its own regiments, with their own banners; all unified under the Rainbow Banner of the Child of the Sun. And they are better

armed than the Aztecs. Their spears and battle axes are copper, not stone. And their maces have copper spikes. They use wooden shields, sometimes bossed with copper, and wear thick, quilted jackets for armor. They carry slings, arrows, javelins, and lances. And two weapons you have never seen before: the *lasso* and the *boleadora*, or bolo.”

Pizarro nodded gravely. “Yes.”

Manco had told him all this already. Pizarro’s first questions back in Tumbes had been military. The captain had not come out into the night to rehash matters long settled.

“Soon we will find if the gamble was worth it, eh, Sanchez?” Pizarro’s voice sounded nervous. And small wonder. A score of men to challenge an empire? It would be madness, if it hadn’t been done once already. “Next month,” he said, “we may be lords or we may be dead.”

“Is it so important to be lords,” asked Manco, “that the alternative may be death?”

Pizarro spat into the night. “There is nothing more important. A man takes charge of his own destiny, or he is as good as dead. I am a bastard. Did you know that, Sanchez? A bastard. Most of us here are. Diego, too. Outcasts in our own land. Less than nothing. My father would not acknowledge me; would not treat me as he did his legitimate sons, though everyone in Estremadura knew the truth of it.” Pizarro’s voice hardened and Manco thought he saw his eyes narrow in the dusk. “He raised me as a peasant; set me to tend the pigs. I cannot read nor write, you know. Not even my own name. Sometimes I won-

der how my life might have gone had I . . .” He shook himself.

“But that is milk long spilt. One day, I lost some pigs. Flies stampeded them. Oh, I ran after them—the pigs, that is—slipping and falling in the rank mud, and I rounded most of them up, but . . .” Again he paused. “I could not face my father’s wrath,” he concluded, “so I fled to the Indies, ‘with a cloak and a sword.’”

“Flies,” said Manco.

“Yes. You find that amusing?” Pizarro turned his head sharply, and his face said that there had better be no humor found.

“They say,” said Manco, toying with the fringe of his cloak, “that a butterfly’s wings flapping in Spain can create storms in France.”

Pizarro scowled at him. “What do you mean by that?”

“Butterfly’s wings,” he repeated as if to himself. “It means that from small, unnoticed beginnings, great events may grow. Were it not for the buzzing of some flies in Estremadura, you would not be here now banging on the Inca’s door.”

Pizarro grunted. He hunkered down on his haunches and ran his fingers through the dirt. “Good soil,” he commented. Manco said nothing and after a while Pizarro threw the dirt down. He laughed bitterly, his forearms resting on his knees. “When I pause and consider it,” he said finally, “I find it very improbable for me to be here.”

“Why is that? The flies, again?”

“No. That was but the first chance. There were others. Times when the least change in direction might have taken me to an altogether different fate. I was with

Ojeda on his expedition to Cartagena and, so, I might have died there, and not here.” He shook his head. “That Ojeda! There was a man for you! The Indios on the Cartagena coast are the fiercest anywhere. We took great losses fighting them. Juan de la Cosa died there, as fine a man as ever lived; died with a poisoned arrow through his throat, kicking and twitching and fouling himself. He had been Master of the old *Santa Maria*. The first man to see the Indies. Dead in the steaming mud of some tropical sty. Ojeda was wounded, too. He knew the arrow was poisoned, so he told the doctor to bind the wound with red-hot iron plates; threatened to hang the man if he did not.” Pizarro shook his head again. “But I escaped unscathed from the battle.

“Ojeda left on a passing pirate ship and put me in charge until Enciso, his second in command, should arrive with the follow-up ship. When he did . . .” and here Pizarro laughed. “When Enciso finally arrived, he brought some rare wine with him.”

“I don’t understand,” said Manco. Pizarro seemed to be struggling with some inner turmoil. Some half-forgotten memories challenging him. For the moment, the hard ruthlessness had slipped from his face, and Manco saw that it was not Pizarro’s future pulling him toward his fate, but his past, pushing.

“Vasco Nuñez de Balboa,” he said, “was a stowaway aboard Enciso’s ship. He had hidden from his creditors in España in an empty wine cask. And there was another turn of fate, because it was Balboa that saved us. We were in poor shape, barely surviving on that

rank shore. Balboa led us to where there was food, but no poisoned arrows. Enciso was seething all the way; but the man was no leader and Balboa was. We built a city there and called it Santa Maria la Antigua; but now it is called Darien. We proclaimed Balboa as *Alcalde*. Any real man," Pizarro declared, "recognizes another real man. The men loved him—I loved him—we would have followed him anywhere. 'I always lead from in front,' he used to say. I suppose," Pizarro concluded, looking at his hands, "that that was his secret."

Manco let the silence draw out for a while before asking: "And where is this Balboa now?" The hammer blows must be aimed just right.

Pizarro winced and gave Manco a quick glance. "Dead. For all the glory he found, being the first among us to espy the great South Sea, his head decorated the city gate of Darien. Enciso saw to that; though he took years with his revenge. And I . . ." Pizarro frowned and began drawing aimless diagrams in the dirt. The moonlight glittered off his helmet. Manco heard him sigh. "I was the one sent to arrest him. He was thatching his roof when I came. He was dressed as a common laborer and was working side-by-side with his Indios." Pizarro added a filligree to his design. "He was far from a tender man, but he always treated his Indios well. Once conquered, he said, the Indios were our own and should be treated decently. He saw me coming and he must have known why, for he climbed down from the roof and greeted me. 'You never used to come to me like this, Francisco,' he said, 'when we were on the Cartagena coast.' "

Pizarro looked at Manco. "But what could I do?" he demanded. "I had my orders from Pedro the Joustier, the Madonna-forsaken Royal Governor of Darien. What else could I do? Enciso had charged him with mutiny and . . ." He looked suddenly away. "And that is enough of this sort of talk."

Pizarro stood abruptly and dusted his hands. Manco stood also and bowed to the captain, peering closely as he did so. Pizarro strode off and Manco looked after him. He had not been mistaken. There were tears in the old man's eyes.

Manco smiled.

There was a tambo set in the pass. A vast complex of many buildings with stout walls of dressed and fitted stone. Ruiz tried to fit his sword blade between two stones and could not; and he marvelled that it could be done with no mortar. The buildings loomed over them, dark and ominous, the walls lined with feathered soldiers in burning red uniforms, who watched the Spaniards impassively as they stepped their horses over the cobblestoned highway.

Benalcazár looked up and shuddered. "How many are in that fortress?" he asked.

Manco reined in and studied the soldiers on the parapet. He shrugged. "I do not know. Some of the tambos serve as garrisons for the Inca's regiments."

Pizarro turned to speak to Manco. "Why do they do nothing?" he asked.

"Because they have received no orders concerning us."

Almagro looked back from where he rode at the head of the column. Then he looked at the soldiers lining the walls and laughed. Pizarro frowned and shook

his head. "I do not know if that is a good or a bad thing in a soldier."

He clucked to his horse and the column resumed its slow walk through the pass. Snow fell. Tiny flakes that melted before they struck. Manco looked up at the walls, at the soldiers who leaned there on their spears. That had been a lie, that part about them receiving no orders. Very specific orders had been given. But it was also true that, lacking orders from above, the garrison would still have done nothing.

Much like the soldiers of any totalitarian state, any place.

Or any time.

The soldiers returned his stare with stolid lack of interest. *Like robots*, thought Manco. But the thought of robots made him think of everything he had left behind forever. Abruptly, he turned his horse and cantered to his post at the head of the column.

Bartolomé Ruiz, the navigator, was an inquisitive man. Perhaps it was because his work accustomed him to the close observation of nature; to measurement and calculation. Perhaps it was because he was simply curious about so many things. Whatever the reason, he was the closest thing to a scientist on the expedition.

Of all the conquistadors, Manco feared him the most.

The road trended downwards, now. Gliding toward the valley of Quito. They saw more terraces and irrigation canals. Indios tending the fields of maize paused in their work to stare as the white-skinned men marched past. They backed away in fear from the strange, giant llamas.

Ruiz quick-stepped his horse and fell in beside Manco at the point.

"Soon, now, eh, Manco?" he said. Ruiz was the only officer who called him by his first name.

"Soon," he agreed, and wondered what Ruiz wanted.

"Francisco has told me of your butterflies."

Manco looked at him. "We spoke of how small beginnings may build into great conclusions."

"Surely. I found it a fascinating notion, and have thought about how we here have reached this great conclusion of ours. It was a long, uncertain road we traveled. Did the Captain tell you that he was not Pedr'arias's first choice to head the expedition here to Birú? It was Don Andagoya that first raised these shores and heard rumors of a great empire. But he was too badly injured to attempt the return. The Joustler chose another captain to go in his place; but that man had the good grace to die before the expedition set sail. Only then was Father de Luque able to obtain the governor's sanction for the partnership to undertake the task." He gestured over his shoulder to where Pizarro and Almagro rode side by side, conversing in low tones. "So there you have a chain of chance. What if Don Andagoya had not fallen in the river? What if Pedr'arias's next choice had not died? What if de Luque had not convinced the governor to back Francisco?" Ruiz spread his hands in question.

"Chance guides us all," said Manco.

Ruiz shrugged. "Or God's Will. Which may be much the same thing." He twisted and untwisted the reins around his hand and looked off into the

distance. "We set sail for the first time in December of '24. Just Pizarro and one ship, with one hundred men. Almagro was to follow us with a second ship." Ruiz shook his head. "That was a hard voyage. We named our encampments Burnt Village, Port Famine, and the like; so you can see that we had no enjoyable time of it, tramping through the swamps and the rain-soaked forests. That first trip was the beginning of years of exhaustion, sickness, and starvation. And fighting. The captain was wounded no less than seven times by the Indios. Almagro never appeared; so we finally raised anchor and returned to Panama, though the captain asked to be put ashore at a small coastal village, and not at Darien. He declared he would set no foot in Darien until he had found the Golden Empire. That was when the two of them fought for the first time, he and Almagro. Almagro swore he had scoured the coast for us without success; and that he had lost an eye to the Indios as token of his efforts."

"A loss that did not add to his beauty," said Manco.

Ruiz laughed. "No. Though it did not subtract a great deal, either. The captain realized that no one surrenders an eye for appearance' sake, so they quickly became reconciled. But then there was further trouble. The Joustier was loathe to finance another voyage, considering our losses on the first. But we argued the case with him, especially Father de Luque, who was friends with Judge Espinoza. He managed to raise 20,000 *pesos de oro* for the effort. Pedr'arias laughingly sold us back his interest in the profits of our exploration, saying there would be no profits. So we weighed

anchor a second time in early '26 and felt our way down the coast. We lost men constantly to hostiles. Primitive tribes that ran naked through the forest. Nowhere did we see signs of gold, yet everywhere we heard tales of it. Almagro returned to Darien and fetched more recruits and we continued south, still fighting bare-assed savages. The captain would have been killed at one engagement, save that he was thrown from his horse."

"Being thrown in battle is usually fatal."

"Aye. But the Indios thought that some strange beast had divided in two. They were thrown into panic and we were able to withdraw. So there was another chance event that guided our course. Pizarro made camp on an isle beyond reach of the bare-asses' canoes while Almagro returned to Darien yet a third time. Shortly, ships came, not from Almagro but from the governor, offering to return us to Panama. The governor had decided there would be no more costly southern fiascos." Ruiz leaned over his horse and spat.

"I have heard this tale."

"But did you hear how the captain responded? He drew his sword and scratched a line in the sand and said that any who wished to wager his life against the hopes of gold and riches might cross the line and stay with him. As for himself, he declared, he would remain — alone if need be—and await Almagro's return." Ruiz grinned at him. "Thirteen of us crossed the line, twelve at my heels. Even those returning to Darien were moved by the grandness of the gesture. If you search for butterflies' wings, Manco, you will find them flut-

tering on that island on that afternoon. Never has so momentous a course of action been decided on so small a gesture."

Manco grunted noncommittally. "If you could change any of that, what would you change?"

"Change?"

Manco spoke carefully. "What if you could sail into the past as easily as you sail on the seas? Where would you go and what would you change?"

Ruiz gave him an odd look. "Why, I suppose I would wish that more of us had crossed the line to stand with the captain." He gestured over his shoulder at the weary column of men. "We are a thin line."

"The tip of a wedge is thin also," Manco told him. "Yet, hammered into a crack in the rocks, it may tear down mountains."

Ruiz grunted, but said nothing. Manco thought he was considering the problem of tearing down the Inca realm. Even simple machines, thought Manco, can accomplish great tasks. Though sometimes the machine is not so simple, and the task, almost insuperable.

"And how would you accomplish it?" he asked finally. "How would you induce more men to cross the line?"

"What? Oh." Ruiz frowned at him, then appeared to ponder. The horses' hooves made soft sounds on the packed earth of the trail. "I would need to work on the men long before the moment of decision came," he decided after a while. "Or, rather, knowing what I know now, I would have guided both the captain's and Diego's ships directly to Tumbéz in '24. Then the first expedition would not have been such a dis-

mal failure. The Captain and Diego would not have quarreled. And the people of Darien would not have withdrawn their support." Ruiz's voice sounded almost startled. He was thinking new kinds of thoughts.

Manco nodded. "Yes, the outcome is often decided far in advance of the actual event. Always we find the roots in some small, unnoticed detail. It is like a lever, where a small push on one end moves great weights on the other. The Greek philosopher, Archimedes, once said that given a place to stand and position his lever, he could move the world. What he did not say was that the true difficulty lay in deciding just where to position the lever to achieve the proper movement."

Ruiz thought about it, searching Manco's face. "You are right, castaway. It is one thing to say that your butterfly's wings could cause a storm; but quite another to know where to place the butterfly to create the particular storm you desire." Then he laughed. "But enough of this wild talk. We discuss the impossible. What is done is done and may not be undone."

"As you say," said Manco, smiling. "Provided one did not possess a caravel in which to sail the seas of time. But with such a craft . . ." He let the words linger in the air a moment. "With such a craft, it would be a different matter. Certes, the event we would wish to change is but the last link in a long chain. And yet, if one were to study on it, one might find the one weak link. The link that a single, ordinary man could snap, and so change all that came after."

Ruiz considered him with narrowed

eyes. "And such a weak link is . . .?" he suggested slowly.

"Perhaps a civil war among an emperor's sons. Or a line drawn in the sand of a tropical beach. Or a flock of flies in Estremadura." Manco spoke the lies smoothly. He did not mention the one link that was crucial. "It was a hard question, deciding just where the butterfly's wings should flap."

They rode a while longer in silence. Then Ruiz reached across suddenly and seized Manco's bridal. "Was? It was a hard decision? What are you trying to say? Who are you, Manco?"

Manco looked at him calmly. "A butterfly."

Ruiz swore an oath. He yanked hard on his horse's reins and galloped back to where Pizarro and Almagro rode. Manco watched them talk; watched Ruiz geture and point. *Another blow struck*, he thought. Soon the structure would begin to crack. *But, will it crack properly?* The ghosts of family and friends not yet born whispered to him on the wind that scoured the altiplano. *You will kill us, Manco*, they said. *We will never have been. You will never have been.*

It was a chill wind and Manco pulled his cloak tight about himself.

Pizarro, Almagro and Ruiz took him aside. They shoved him up against a high stone Inca wall and hemmed him in. Almagro and Ruiz stood to either side with their arms folded across their chests, and Pizarro faced him directly with a dagger held close between his eyes. The point flashed in the noonday sun.

"What is this wild tale that Ruiz has

brought me?" he said, his eyes as hard and gray as the stones around them.

"What tale is that?" said Manco, watching the dagger.

"That you plan to destroy our expedition! To save your heathen empire!"

Manco turned his eyes toward Ruiz. "No. He misunderstood me. I spoke only of butterflies."

"You spoke of changing the past!" Ruiz accused him. "Deny it!"

"Change the past," said Pizarro. "What witchcraft is this? How are we to change the past?"

Manco shook his head. "Not the past. The future. You are the past."

Ruiz unfolded his arms and shifted his stance. Almagro traced a hasty cross over his body. Pizarro looked at him oddly, and the dagger sank a few centimeters. "We are the past," he repeated.

"Yes. I was born in these mountains four hundred and fifty years from now."

"Four hundred and fifty years?" Almagro whispered. "Mother of God!"

Pizarro braced Manco again. "I do not believe you," he declared. "You are mad. Why should I believe you?"

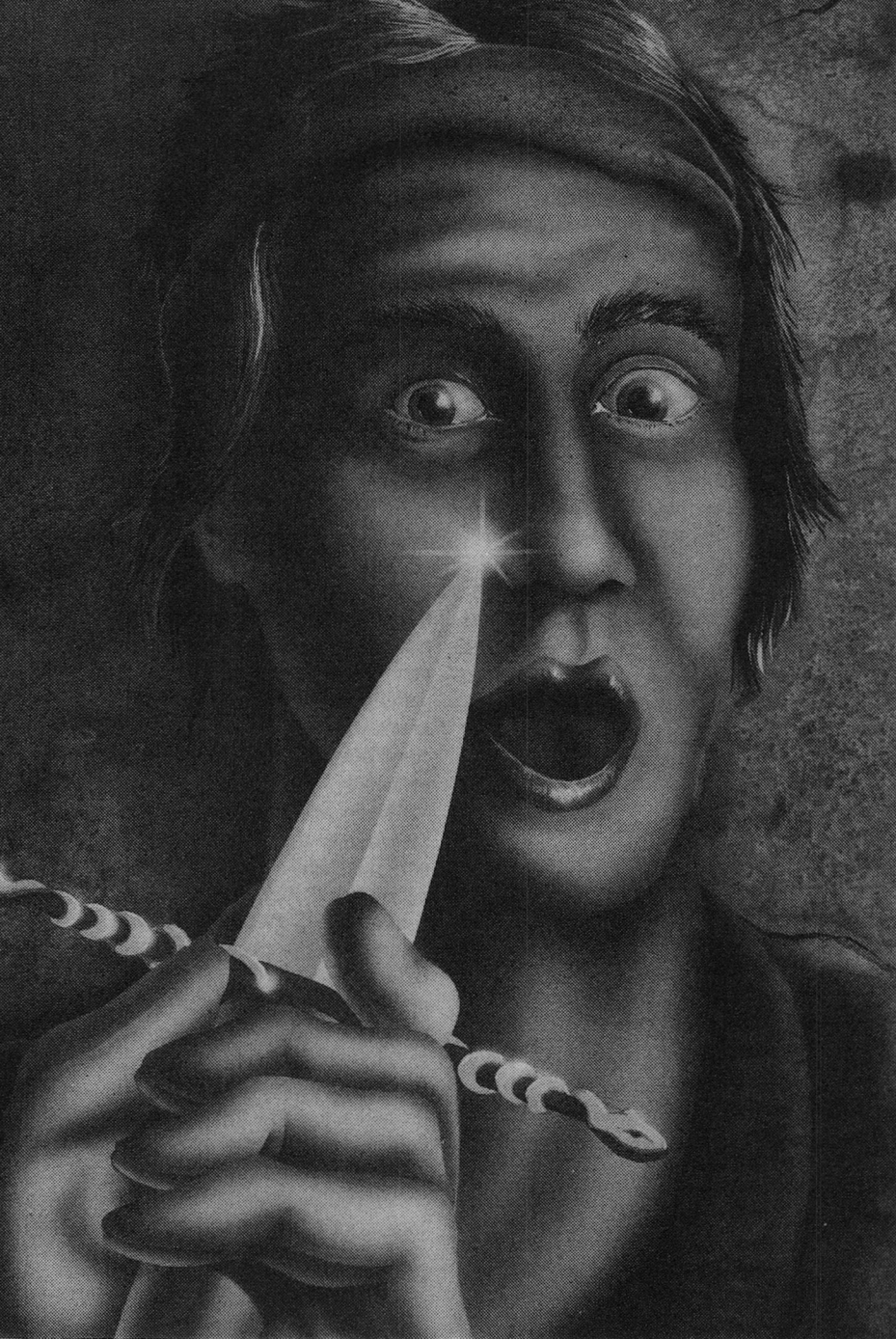
"Are you a magician," asked Ruiz, "that you travel through time?"

"Are you a magician," countered Manco, "that you sail the Ocean Sea?"

Ruiz blinked, looked thoughtful, then laughed. Pizarro turned his head and frowned a question, and Ruiz explained. "Surely our own technology," he said, "must appear as magic to the heathens."

"I've never been a wizard before," Almagro commented dryly.

Pizarro was unconvinced. He held the



dagger closer and put his face into Manco's. His breath was foul and stank of rotted teeth. "Can you prove this wild tale of yours, Sanchez?"

"To what purpose? I am what I am. If you believe me or not, what is that to me?" It was a great deal, of course. But Pizarro was not to be pushed into belief. He must be led, one step at a time, until there was no turning back.

Pizarro hesitated. He licked his lips and he glanced once more at his two companions. Then he laughed his harsh and brittle laugh and put his dagger away. "True. And what is it to me?"

"He is leading us into the Indios's empire," Ruiz pointed out.

Pizarro shrugged. "He leads us where we wish to go."

"Does he? What if he is a madman? Should we follow him? And if he *has* come from the future somehow, then he must have some purpose of his own, this self-confessed butterfly." Ruiz turned on Manco. "Well? Speak, and speak plainly. What is your purpose here?"

"I seek," said Manco, "a better future."

Pizarro gripped his dagger hilt. "How?" Then he jerked his free arm up. "No. This is madness." He half turned away.

"He plans to destroy our expedition," declared Ruiz. "To save his empire." The words were a challenge. Manco looked at the navigator.

"No," Manco told him. "The empire must fall. Where there is no choice there is no morality. When everything is prescribed by law, there can be nothing new. It has stunted my people, turned

them into unthinking cattle. Easy prey for brigands such as yourselves."

There was no insulting men like these. Words like "brigand" rolled off them like the rain off of down. If they were brutal, it was at least an honest brutality; and they made no excuses, no mealy-mouthed euphemisms either to others or to themselves. "Then for what?" asked Ruiz.

Almagro laughed. "Why, then, he must have come to assure our success, amigos. He wishes to smash his forefathers' empire and we are the instrument he has chosen." He clenched his fist in an unconscious gesture.

"Does your history record this expedition as a failure then?" asked Ruiz. "Are you here to change that fate?" Pizarro turned back toward them. Manco could see the curiosity in his eyes. A part of him wanted to know, and another part did not want to know. His lips parted but no words came out. If you speak your dreams aloud, they do not come true. But who can resist to speak of them?

Manco addressed his answer to Pizarro rather than Ruiz. "Our histories tell," he said, avoiding the specific question Ruiz had asked, "Of how the conquistador, Pizarro, conquered an empire with but a handful of men. How he aided and befriended Atahualpa and then garrotted him for his gold. How the king of Spain made him a marquis and a governor."

Pizarro seemed oddly unsatisfied with the announcement. If success is foreordained, where is the savor? Ruiz and Almagro were puzzled.

"If you have not come to save the Inca," said Ruiz, "and you have not

come to save us, then tell us: just why have you come?"

Manco took a deep breath. This was a critical point in his plan. "There is a limit," he told them, "to what an individual such as myself may accomplish alone. I spoke earlier of change. Of finding the right place to put my lever. Of finding the the weak link in a chain of events. The time when a small seed may grow into great fruit."

Pizarro looked at Ruiz, who nodded. "Yes, I remember."

"Then, attend me. The place for my lever is here, on this cold mountain trail, and now. I want to alter the Conquest. Not *whether* it happened, but *how* it happened. The Spaniard is coming to these mountains. That cannot be stopped, least of all by myself. Nor would I block it if I could because, as I said, the Inca realm must fall. But, my captains, the Conquest was too cruel. It destroyed and embittered the Indios. In my time," he told them, "the sad remnants of Tavantinsuyu are the poorest states in Latin America. Because of continual insurrection and political instability, our peoples, Hispanic and Indio alike, will live in abject poverty, illiterate, condemned to mind-numbing peasant labor, *tending pigs for their padrones.*"

That struck responses in both Almagro and Pizarro. The squat, ugly man nibbled his lip and frowned. Pizarro sneered. "Then let them do as I did," he challenged.

"The Incas," Manco said in a pleading voice, "will not accept your rule. Rebellion will follow rebellion: Manco Capac. Tupac Amaru. Tupac Amaru II. Down through the centuries. Long after the Aztecs and the Mayas have forgotten

who they were, *we will remember!* In my own time, I was a member of The Shining Path, an Inca society dedicated to the overthrow of the Hispanic Republic of Peru and the restoration of the Inca way, or Maoism, as it will then be called. That must not happen, that long history of hate and rebellion. We must forge a new destiny, one that will lead to a better future."

Manco suddenly realized that he was appealing to Pizarro's better nature; which was a mistake, because the man did not have one. Pizarro hated weakness, and Manco could see contempt for this pleading in the other man's eyes. His goal was slipping away from him.

"There is a limit, you said, to what one man could accomplish." That was Ruiz, intent, as always with getting to the bottom of things. Manco turned to him once more.

"Yes."

"Then how did you propose to change that course of events you have outlined by accompanying us?"

"The Empire must fall." *Forgive me Tavantinsuyu!* "The Empire must fall; but it must fall in just the right way. There is no need for Spaniard and Inca to become enemies—"

Pizarro laughed sharply. "No need? Your Inca has an Empire and we mean to take it. Is that a basis for friendship?"

Manco could feel the sweat from the noon sun roll down his neck. The men facing him were tense, edgy. The wrong words now could mean his death. "If you have gold and power," he said carefully, "would it matter overmuch who it was had given it you?"

Questions of gold and power always interested Pizarro. "Say on," he said.

"I mean that the Child of the Sun can be no less generous than your own king when it comes to granting titles and wealth."

Pizarro and Almagro exchanged long looks. "Your Indio emperor would give us gold and make us nobles?" asked Pizarro, "And for what? Why should he do such a thing?"

"Why, for breeding your horses and teaching his men to ride them," Manco answered, pointing to the steeds where the other men sat waiting. "You have both stallions and mares in your train. And for smelting iron and teaching his smiths to work it. For teaching navigation and boat building. For a hundred skills which to you are commonplace but which are unknown here."

"And for staying here and never returning to Darien," said Pizarro dryly.

Manco shrugged. "Is that such a terrible price? Is there a greater prize for you if you return? No, only Spanish *dons* instead of Indio *Incas*."

Manco saw that Ruiz, at least, was half convinced. The thought of playing Galileo to an entire world must be tempting to a man like him. And the others would follow where these three led. Benalcazar would make a fine general on the Empire's southern frontier. Pedro the Greek, the ship's gunner, was an amiable bear of a man. Set him to teaching ordnance and he would be happy. But Almagro and Pizarro . . .

"It will not work, Manco," said Ruiz, shaking his head. Almost reluctantly, Manco thought. "Surely, you know that we are not the only men in Darien who dream of conquest. Others will follow, whatever we decide here."

"Aye. Others will follow," Manco

agreed. "But not for some time. Your treacherous governor is already disillusioned with southern ventures. Señor Almagro could raise no more volunteers on his last return voyage. If you fail to return this one last time, Tavantinsuyu will have a breathing space. A time to change and prepare, so that the contest, when it comes, will not be so one-sided. The Spaniard will still prevail, but there will not be a Conquest, but rather a blending of our two peoples." It did no harm to remind these men that Darien had forsaken them, that their governor could not be trusted.

Pizarro snorted. "I bleed for the Indios," he said. "If that was your intention, then you should have had Balboa here, and not I."

Manco looked at him. "Balboa is dead," he said distinctly. "That was a knot I could not unravel on my own. Too many forces were tangled up in his murder."

Pizarro flinched. "It was no murder. It was decided by the court . . ."

"A court perjured and bought. Judicial murder, perhaps, but murder it was. And I could not hope to influence the decisions of men like Pedr'arias, or Enciso, or Espinoza and save the noble Balboa."

"And you believe you can influence us?" Pizarro's eyes told him it was a lie.

Manco shrugged. "This expedition was a turning point of history. When things are in flux, their flow may be guided. History is being made here, on this trail, by a handful of bold men. The future turns on your decisions, my captains. Say now, which is it to be?"

He saw the crafty look come into

Pizarro's eyes and knew that his persuasion had failed. "Why surely," the man said, "that is a vision worthy of us. A joining of our peoples. Eh, Diego? Lead us on to this Atahualpa, then. If we can be rich and powerful under the Inca, why concern ourselves with Darien? Pizarro gathered in his lieutenants with a glance and they turned to go.

Manco knew that the conquistador was lying. An overlord in distant Spain was one thing; an overlord in Cuzco was something else. If Manco could see that, Pizarro surely did. Manco began to feel the inertia of history. In his bones; in his aching muscles. It was rolling toward him as inexorably as Juggernaut's chariot.

One more blow, he thought. But aimed just right, lest the target shatter. "Wait a while, Don Pizarro. I have not told you all that would transpire if you continue down the path you have set your feet upon." The trio kept walking, Ruiz giving him a sad and disappointed glance. If the path led to conquest, what else mattered?

"What does history say of Pizarro's partner?" he called after them.

They stopped and turned. Almagro scowled at him and Manco, seeing that dark and ravaged face, thought that Diego's enmity was something he would never want to have. Almagro stared at him through his one good eye. "And what of Pizarro's partner?" he asked in a soft voice.

Manco watched Pizarro as he answered Almagro. "History tells us that, following the Conquest, Pizarro was named Governor, Marquis, Captain-General, Adelantado, and Alguacil Mayor of Peru for life, with the reve-

nues of Peru for his salary. 'Almagro Jake' was appointed simply Governor of Tumbes, with less than half the salary, and the Thirteen were granted the rank of hidalgos. That by a capitulation signed by the Queen Regent at Pizarro's request. History tells us that Almagro felt cheated of his rightful share and that civil war resulted. In the end, Almagro was betrayed and legally condemned by a tribunal chaired by Hernando Pizarro. He appealed for clemency to his old friend, the Marquis; but the Marquis, *don* Pizarro, refused to countermand his brother's judgment. And so, don Almagro was hung. And it tells us how afterwards Almagro's friends burst into the governor's palace at Lima and hacked the aged Marquis to death with their swords."

Pizarro's face turned white, then red with rage. "You lie!" he shouted. He lunged toward Manco, but Ruiz and Almagro grabbed him and held him. Pizarro twisted and pulled in their grasp. The other men, alarmed at the spectacle, shot to their feet and one—Benalcazár, Manco thought—pulled his sword.

Ruiz waved them back. "It is nothing important. Just another argument."

"Christ damn you, Ruiz," spat Pizarro. "Release me and I'll slit yon liar's gizzard."

"Francisco," said Almagro, not relaxing his grip.

Pizarro looked at him. "Diego. Old friend. You know I would not do that to you."

Almagro shook his head. "Does today know what tomorrow will do? Who knows what fate holds for us?" He looked at Manco. "Do you swear it, Sanchez? Do you swear on your mother's

grave that what you have said is the truth? Would it come to that?"

Manco locked eyes with him. "I swear it. It would have come down to that. Jealousy and rage. Betrayal and murder. Civil war."

Almagro sighed and cradled his partner in his arms. Ruiz let go and backed away and Pizarro sagged, no longer struggling "Ah, success," said Almagro. "It is the great corrupter, is it not, Francisco? So long as we searched, we searched together." He looked back over his shoulder, toward the Quito road. "Let us turn aside from this," he said. "Let us go elsewhere and continue searching for El Hombre Dorado. I never feared danger, on the sea or in the jungle; but I fear success, Francisco, and what it might do to you."

"No," said Manco. "You need not turn aside. Travel the other path, the one that I have laid out for you."

Almagro grunted. "That path, too, leads to success. And down that path, you have no map, no memory to guide our future. Can you tell me that the same fate does not await us at its end?"

Manco shook his head but said nothing. Almagro sighed.

"I wish you had never come, with your omens and warnings. Perhaps you are no magician, after all. Only a conquistador from out of time. God's ways are many and marvelous." Almagro shook his head again. "But there is magic here." He released Pizarro; but the captain merely slumped to the ground. Tears drew dark lines in the dirt on his face. "Vasco," the conquistador murmured. "Vasco."

Almagro looked from Pizarro to

Manco. "There is magic here," he repeated.

"Do you suppose it will work?"

Ruiz asked him that as they rode side by side at the head of the column. Great towering cliffs rose above them on either side of the road. The thin cool air of the altiplano whipped through the cañon. Beyond it, framed by the cliffs, Manco could see the plains of Quito. "Do I suppose what will work?"

"The spell you cast on the captain."

"Spell?" Manco cast an amused glance at his companion. "Now who calls it magic?"

"Call it what you wish. It is but a name. What did you do to him?" Ruiz insisted. Then, with an edge to his voice, he added, "I will not see him emasculated."

Manco laughed. "No, Captain Pizarro remains Captain Pizarro. As cruel and as treacherous as ever. I only helped him to confront himself."

"I don't know what you mean."

"And you must know, mustn't you?" Manco smiled thinly. "I know your type." He stared straight ahead, the reins loose in his hand. "The captain himself said it, back at the first tambo where we camped. Your advantage over the Indios lies not in your technology—in your mechanic skills," he added for clarification, "but in your organizational skills. Your software rather than your hardware." He knew that the terms puzzled Ruiz, but he did not explain. "I had software of my own," he continued. When Ruiz said nothing, he added, "The Captain said that your secret weapon was Machiavelli."

Ruiz looked at him. "I remember," he said.

"You had Machiavelli," Manco told him, "but I had Freud."

Ruiz looked backward at the column, where Pizarro and Almagro rode side by side, talking and laughing. "They were drifting apart," he said. "Growing suspicious of each other. Arguing. Everything you told us would have come to pass. I know it. Now . . . I am not sure. Perhaps the breach has been healed. Who was this Freud? A magician who ensorceled men's minds?"

"Yes," said Manco, laughing.

Ruiz shook his head. "With our swords we slice up men's bodies. Your sword slices up men's souls. I think you are crueller than we, Manco."

"Pizarro had betrayed his friend and hero once before. Vasco Balboa, a man he sincerely loved and admired. He had rationalized his actions to himself; but deep inside his mind, in what we call the subconscious, he did not believe those rationalizations. They preyed upon him constantly; poisoned his friendships with anger. He knew that someday, somehow, he would betray Almagro. Not in his waking mind, but underneath it, in that subconscious. He knew it . . . He knew it in his dreams. I forced him to confront that."

"Why?"

"You know why."

"So that he would turn from his path to yours. So he could avoid betraying Diego."

"The shining path," Manco agreed.

"He will still destroy your empire," Ruiz told him.

"That is his destiny. It must be done. The Inca will give you places, honored

places. But you are men who do not know your place. The Inca people cannot conceive of the notion of ambition. I expect . . ." And now Manco glanced back also at the captain. "I expect that the captain will be the next Inca. Why steal an empire and give it to Pedr'arias? It will not take that crafty mind long to realize that no one in Darien will be coming soon; that his expedition will be written off as the final disaster; that he will have time to mold this country to his will."

Ruiz twisted his mouth. "Inca Pizarro. Must we then approach him barefoot and carrying a burden, as you have told us the Inca is approached?"

"No. That will change. Everything will change. Everything that ever was will become what might have been. As it was in the beginning, is not, and never more shall be."

Ruiz crossed himself. "And will it end as you have planned? In partnership rather than conquest?"

Manco looked suddenly away. "I do not know," he admitted. "I am not so wise as all that. I will never know. I smashed my machine, my time caravel, and threw its pieces down a great gorge. I had to. Because of what I have done here, my friends and family will never have been born. People I have known and loved all my life, and millions of others, strangers, will never have lived. Is what I have done so much different from killing them?" He shook his head once, convulsively. "No, I must never go back. I must remain here and tell myself every day that I have helped create a better future than the one I left behind."

Ruiz reached across and gripped his

arm. "And you cannot cast a spell on yourself, can you, to relieve your own inner torment?"

"No, mine is the worst fate of all."

"And what if it doesn't work? What if, in spite of everything, Francisco calls on the men of Darien? You have told us how irresolute your Atahualpa is. Francisco may grow restive as a noble under him; may begin to wonder what he might accomplish with two hundred men and cannon. What is to stop him—or any of us—from seeking our way home?"

"I do not place all my eggs in a single basket," Manco told him. "You will not have the opportunity to reconsider."

"What do you mean?"

"I mean I have already been living in Tavantinsuyu for three years. I wear the fringe of office on my cloak, granted me by a grateful Inca. I had penicillin with me."

"Bartolomé, I neglected to say something earlier. It will make no difference if I say it now. Pizarro's second expedition was a failure."

"What!" Ruiz sat erect. "Then it was all lies, what you told us? About the Conquest? About Francisco's betrayal of Diego?"

"No lies. It all happened as I told you; but it happened on the *third* expedition."

Ruiz slumped in his saddle. He stared at Manco. "The third."

"Yes. In my history, you did return to Darien with the gold of Túmbez. Pizarro showed it to the Queen Regent in Toledo the day after Cortez had delivered the Royal Fifth of the treasure of Mexico. Men flocked to join your banner. You came here again in '29 and took an empire."

"And the civil war was not finished by then? You said that we would take advantage of the civil war between the brothers. You urged us into the mountains on that account. To reach here and exploit the conflict before it ended."

"The civil war?"

They broke from the cañon onto the altiplano. And there the thin, weary line of Spaniards halted in dismay. The cold, thin sun of the high country blazed down upon them. The condors circled above. And drawn up before them in rank after rank were the proud Inca regiments, fresh from the defeat of the Chimu Empire of Quito. Their numbers filled the plain with a countless mass of men, resplendent in their blazing feathers and quilted jacks, their proud banners snapping in the highland breeze. And above them all flew the Rainbow Banner of the Child of the Sun, where he stood arrogantly atop his platform, carried on the shoulders of his nobles: Huayana Capac Inca, a man of infinite resolution and decisiveness, the undisputed leader of an army that had never known defeat.

"The civil war," said Manco simply, "has not yet started." ■



futures

Matthew J. Costello

Starting with this issue of Analog Science Fiction/Science Fact, Matthew J. Costello's regular column, ON GAMING, will expand its focus, and adopt a new name. FUTURES will be a monthly column covering SF in computers and software, films and video, audio tapes, comics and graphic novels, and games and gaming.

Let's start by talking about the past.

And radio. Now I grew up during those early years of the first television sets—great brown mahogany boxes with eight-inch picture tubes. And, except for those times that my parents shrieked at me to “Go out in this beautiful sunshine and play!” there I sat.

But I have an earlier more distant and faded memory.

Radio. Shows that had no picture. It must have been the tail-end of the phenomenon, but I remember sitting by a big table radio listening to the creak of opening doors . . . the squeal of tires.

Now, a fondly remembered medium of the past is about to be wedded to a hot, high-tech “carrier unit.” Over six hours of Orson Welles Mercury Theater broadcasts, including full-length versions of “Rebecca,” “The Shadow,” and “The Hitch Hiker,” will be presented on video laserdisc.

And yes, The Voyager Company

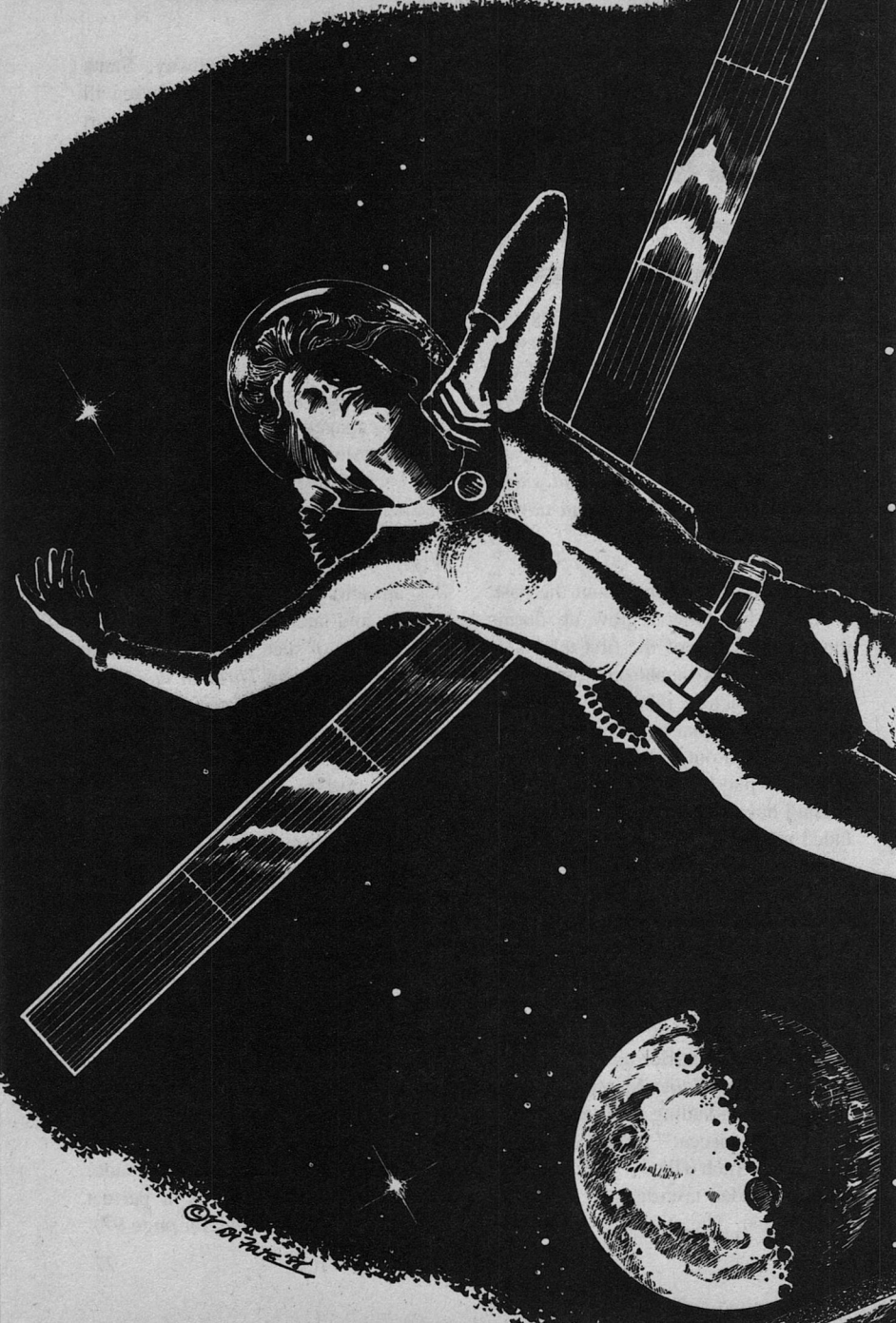
(1351 Pacific Coast Highway, Santa Monica, CA 90401) explains, there will be no pictures on the state of the art video medium. All the optically read tracks on the Theater of the Imagination: Radio Stories by Orson Welles and the Mercury Theater are devoted to audio material, including the radio broadcasts, a documentary narrated by film scholar Leonard Maltin, and a recording of the first personal meeting between Orson Welles and H. G. Wells.

In keeping with the ears-only, imagination-engaged quality of radio, only sound, restored to the highest quality, will be included. The source tapes for Theater of the Imagination came from 160 hours of material left in Richard Wilson's Santa Monica garage. Wilson was an actor in Welles's *War of the Worlds*, and later went on to become a film director of such films as *Invitation to a Gunfighter* and *Three in the Attic*.

While digital re-mastering was used to record the program, sonic “micro-surgery” was used to remove severe surface noise by a process called NO-NOISE.

Voyager, through its Criterion Collection, continues to offer state-of-the-art laserdiscs. Their product is reason enough for any film buff to pick up a laserdisc player. Criterion's *Invasion of the Body Snatchers* was presented in full-screen format in its original aspect ratio. And Criterion's *King Kong* not only offered the best print of the uncut film that I ever saw, but segments from Willis O'Brien's short film, *Creation*, the work that convinced producer Merian C. Cooper that *Kong* could be made. The video laserdisc allows a perfect

(Continued on page 97)





SUNDANCER FALLING

Geoffrey A. Landis

Human beings have certain traits that don't always *look* survival-oriented, but are—especially since no one person has a monopoly on them.

In orbit, the first rule of survival is: act slowly. In an emergency, take time to assess your options; act with deliberation but not haste. Your instincts may tell you to act fast, but your instincts will kill you if you don't think.

You ignore this rule at your own peril.

The explosion was a silent flash of white followed by the flickering glitter of debris spinning off into space. I was loading film canisters onto the *Sundancer* and happened to be looking the right way to see it.

One of the pieces was a space-suited body.

In an instant it shrank away to a speck and vanished. I flicked on the rendezvous radar and swiveled it around to try for a trajectory fix.

The worker who had been flung away from the station had been slightly further out from the rotation axis than *Sundancer*. I punched my radio in to the suit bands, meanwhile running *Sundancer* down the cable to the spot that would match his outward velocity. I'm an astronomer, not a pilot, but I'd trained on the simulators enough to fly in an emergency. I ran an abbreviated preflight check. The red LED display indicated *Sundancer* had full tanks. While it carried fuel only for orbital adjustments, not major burns, there was enough to get back to *Antaeus* if I didn't use up too much in the rendezvous. I flicked my radio to the control com channel. "Control, this is Virginia Talens on *Sundancer*. I'm going for a rescue. Out." I flipped the radio off before anybody on *Antaeus* could tell me not to.

Peggy smiled silently at me from her spot taped to the control panel. I smiled

back at her, and pulled the emergency release. Ninety-seven seconds—exactly one third of a revolution—after the explosion, *Sundancer* blew free of her cradle. The observatory shuddered from the shock of disengagement, and gee dropped away to freefall. In the viewport, the lazily rotating bolo of *Antaeus* shrank away against the brilliant crescent of the Earth.

There really wasn't any choice. The station had no tugs, and no shuttles were docked at the moment. *Sundancer* was the only vehicle available with enough delta-vee for a rescue.

Sundancer was a free-flying solar observatory designed to be boosted by ion-tug into an eccentric solar orbit, aphelion at Earth's orbit, perihelion inside Mercury's. It had been in assembly at a docking-and-repair station about a third of a gee down the cable from *Antaeus*'s rotation center—high enough gees to keep things from floating around, not enough to be bothersome.

Sundancer's heart was the PB-4 automatic camera. The mission was to make close-in, high-speed telescopic observations of the surface and corona of the sun. The PB-4 ran at twenty-thousand frames per second: at top speed, the film runs through the camera well over the speed of sound. That's *fast*. We could kill a kilometer of film in just about the time it would take you to sneeze. The film itself was a cross-linked carbide polymer. It had to be, to take the stress of feeding through that camera.

I looked back at *Antaeus* station. It was unlikely and beautiful, a spindly, three-armed white octopus studded with

antennae, docking ports, windows, and manipulator arms. While humans don't absolutely need gravity, it is rather convenient for many industrial operations — try pouring molten steel in zero gee, for example—and it is useful to do your exercising under gee to avoid space adaptation: bone calcium loss and reduction of muscle mass. To simulate gravity, you make the station radius large and spin it slowly; otherwise the spin causes dizziness and disorientation whenever you stand up or turn your head. *Antaeus* consisted of gee stations dotted up and down the cables and a large spherical manufacturing station at the hub counter-spun for zero gee. Two-person emergency reentry pods clung in bunches like grapes around the living quarters. They were little more than a foam-glass heat shield and a parachute, but in an emergency station personnel could suit up and let *Antaeus*'s rotation toss them into the atmosphere.

Such a station design has another advantage. By moving to the appropriate spot and letting go, a ship can be flung just about anywhere in Earth orbit. The rotating station can also catch upcoming shuttles traveling at less than orbital velocity, and fling them back into reentry orbits when they leave, although angular momentum management for that can get rather tricky sometimes.

I looked back at Earth. It was apparent that the unlucky construction worker had been flung outward and slightly posigrade relative to the station. I plugged the computer into the radar to see what sort of orbit we were in. Not good; it intersected the Earth's surface. But the orbital period left plenty of time for a

rendezvous and rescue before the approach of atmospheric entry.

I'd cut loose from the station a few meters farther out from the center than the doppler reading said the overboard worker had been, so I should be closing at a meter per second or so. After a few minutes the scan radar picked up a blip. It wasn't tumbling, so whoever it was had survived the explosion at least long enough to kill his spin. I made a correction burn to adjust my trajectory, and then focused the high-gain antenna on him. "Hello? Can you hear me?" Static. "Hello, this is Virginia Talens on *Sundancer*, can you hear me?"

"Roger, *Sundancer*, loud and clear." The voice had a distinct western drawl, although with the reception quality it was hard to tell much more. "Where are you? Over."

"You should be able to see me in a moment or so. I'm coming at you from about thirty degrees positive of the disk. Are you OK?"

"Roger, *Sundancer*, I'm fine. Explosion knocked me off my perch and cut my tether, but no other damage. I do appreciate your coming out to give me a ride back home, though. Name's Cowboy, by the way. Over."

"Pleased to meet you, Cowboy."

"My pleasure, believe me, *Sundancer*." A short pause. "I think I'm seeing you now. Over."

I glanced out the viewport. "Right, I have visual contact on you as well." He was wearing a bright red p-suit, the solar panels fully extended like glossy blue butterfly wings to power the oxygen regen system. As I watched, the panels retracted. "Be there in a mo-

ment. By the way, can you tell me what happened?"

A chuckle. "*Sundancer*, from where I was it was a little hard to tell, you know? I think one of the welding tanks blew. Ha! That was some ride. Over."

I stopped chatting and concentrated on killing my momentum for the rendezvous. When I was down to a few centimeters per second relative, I rotated the vehicle around so that the lock was forward. In a moment I heard a thump, and shortly afterwards the lock cycled.

She was a compact brunette wearing a red piezo-electric spacesuit with "Orban Construction" embroidered in gold letters down the sleeves. Cowboy? Funny name for a woman, but then high construction workers always were a trifle peculiar. She couldn't have been older than maybe twenty. She unsealed her helmet and took it off, then shook out her short brown hair with a sigh of relief. "Ah, that's better." I looked her over intently, but her hair was too dark, her eyes the wrong shade of grey. She touched a control and the skin-tight suit loosened.

"We can chat on the way back," I said. "We'd better make haste, we're getting farther away by the moment. Brace yourself for gee." The computer had the burn already computed. I keyed in the firing command, and the position thrusters kicked in at a hundred milligees. "Here we go," I said.

And then they died.

"Trouble?"

"Don't know." I opened the control system access panel. "Give me a moment."

In a few minutes I found the problem.

Sundancer was still being completed; it wasn't supposed to be ready for a test run for another week yet. The control panel—as I found out—had yet to be fully wired. The thrusters were hooked in, all right, but behind the panel the wires from the fuel gauge floated freely. They weren't connected to anything. The "Full" reading on the panel was meaningless.

I called up a display of our trajectory on the nav screen. The orbit we were in—if you want to call it an orbit—was essentially a parabolic arc terminating on the Earth's surface. *Sundancer* was a deep-space station. It would break apart entering atmosphere. "I think," I said, "it's time to call home for advice." I turned on the radio.

At *Antaeus*, control had been tracking me on radar and frantically trying to get in radio contact. I'd left the mission control radio off; I'd been concentrating on using the high-gain antenna to pick up signals from Cowboy's suit radio. The mission communicator told me, in explicit colorful detail, all about my failings, starting from ignoring regs by taking off with no flight plan up through the crowning stupidity of relying on a single reading from a single instrument. I was supposed to have been checked out for space, how could I forget that? I listened meekly. I could hardly object; he was clearly right.

When he paused for a moment I said, "How soon can you come out to get us?"

"We're working on it," said control.

"What do you mean, you're working on it?"

"I mean, we're looking at options now. There's a problem."

“Problem?”

“As far as we can tell, there are no ships available that can get to you before you reenter.”

Great. I flipped the radio to standby.

“So we *are* in trouble,” said Cowboy.

“Looks like it,” I said. “But things aren’t desperate yet. We still have time; wait a few minutes and they’ll probably think of something.”

“OK,” said Cowboy. She started her post-EVA suit check. “Anyway, I wanted to ask you something. Right as I took off my helmet, you gave me a peculiar look. Like if you thought maybe I was going to be someone else.”

“Oh. Yeah. Maybe I did.”

“How come?”

“It’s a long story.”

“OK.”

“Well, it’s this way.” I paused and licked my lips. How to tell it? “When I was a kid, I had a sister. Peggy. Two years younger than me, she was, but we were still pretty close.” I gestured at the control panel. “That’s her, over the attitude set panel.” Cowboy floated over and looked at the faded picture in silence. It wasn’t really a good likeness, but it was the best I had. “One day, when I was fourteen—this was back in the ’80s—she ran away from home.”

“I reckon that’s something everybody has to do,” said Cowboy. “Part of growing up. Did it once or twice myself.”

“Yeah. So did I, once. It was over some trivial matter, I hardly even remember what anymore. So my parents weren’t too worried when Peg ran away. She’d threatened to do it before, and never lasted more than an afternoon.

This time she was gone for a day, and a night, and another day. Finally they called the police.”

“And?”

I shrugged my shoulders. “Nobody knows. In those days, people sometimes just disappeared. She was always the adventurous one in the family; I used to wonder if maybe she ended up someplace exotic, Tahiti or Alaska or Katmandu, and just didn’t want to come back. Every day I’d run to the mailbox, hoping for a postcard. For years and years I used to look carefully at everybody I saw on the street, wondering if it might be her. I guess I still do, a little bit.”

“Oh. So you were hoping I might be her?”

“Not really.” I sighed. “Not consciously, anyway. I know she’ll never come back. But I felt guilty for a long, long time, because she’d told me she was going to run away, and I didn’t try to stop her. Eventually I got over it. Mostly.”

“Oh. I’m sorry.”

I shrugged my shoulders again. “It’s OK.”

I was still lost in the past when the radio beeped at me. I flicked it on.

“This is Control. Are you there?”

“Roger, *Sundancer* here,” I said. “Where else would we be?”

He ignored the attempt at humor. “We’ve been looking into the possibility of doing a rescue launch from the surface.” Oh oh, I thought. If they had to go for a surface launch, we were in some serious trouble. “We’ve just had confirmation that there are no vehicles

in position to rendezvous with you before reentry. Sorry.”

“You’re worried about your observatory.”

“Damn it, *Sundancer*, the observatory can be replaced! We’ll sacrifice it in an instant if that’s what it takes to do a rescue. We’re worried about you. Damn you, Talens, you shouldn’t have risked your life to go out after a castaway. That’s not your job.”

“I was the only one in position to do it, and I had a radar fix.”

“And now there are two of you in trouble, not just one. Bright move.”

It would have been worth the risk if it worked, I thought, but I didn’t say it. Besides, I didn’t think our situation was desperate yet. “Control, we’ve been thinking of an idea here, and we want to get your opinion on it.” Actually, “we” was a politeness. I was the one doing the figuring; Cowboy was just floating in the corner. “We have about two kilometers of PB-4 film here, and we’ve been wondering if we can use it to do a tether reboost off *Sundancer* to lift ourselves out of the reentry envelope.”

“Copy that. We’ll look at it.”

The idea is straightforward. Consider two objects in orbit, connected by a rope—in our case, the film. One of the objects, *Sundancer*, say, is slightly closer in than the other, two people in p-suits. Orbital mechanics tells you that the object in the lower orbit will try to move faster. The tether won’t let it separate, though, so it pulls them forward, increasing their orbital velocity. Think of it as a whiplash effect. Just before perigee, cut the tether. The people on the high end of the tether get tossed into

a higher orbit, while *Sundancer* reenters slightly earlier. But could we be thrown into an orbit high enough to avoid reentry?

The radio beeped. “*Sundancer*, please verify. You have two kilometers of film on board?”

“Roger. Is that enough?”

“Have you checked for more?”

“Roger, we checked. Not too many places to look here, Control.”

“Sorry, *Sundancer*. Our simulations show that two kilometers won’t do it. The best you can do is to delay reentry by about eight minutes.” There was a pause. “Good idea, though. Keep on thinking. Over.”

After a while I had the beginning of another idea. “Cowboy?” I said. “How did you get that nickname?”

“Guys on my first crew gave it to me when they heard I grew up in big sky country. Wyoming. Fact, I was junior division rodeo champion of my county one year, back in high school. Guess maybe I should never have left.”

“Maybe.” I keyed up the radio. “Hello?”

“Control here.”

“You said that our trajectory doesn’t pass near any tugs or satellites, right?”

“Roger.”

“When you say ‘near,’ you mean near in space and near in delta-vee, right?”

“Right.” Rescue in space is more than just a matter of getting to the right place at the right time. You also need matching orbits. “Close is irrelevant if relative delta-vee is too high to match.”

“Does that mean that there *are* some

satellites we pass close to in space, but not in velocity?"

"One moment." He didn't ask why I wanted to know. "Roger on that. We show *Molyna 78*, a dead communications satellite, passes close enough that if you make a burn with your attitude thrusters, you could spit on it as it goes by. Relative velocity at closest approach is point six two kilometers per second."

"Thanks, Control. I have an idea here, and I'll get back to you. Could you send through the orbital elements and a schematic of the external configuration?"

"Roger on that. I'm down-loading it to you now."

"Thanks. Can you do one more thing for us? Could you get somebody to look up for me the elastic properties of type PB-4 film?"

"Copy, *Sundancer*. We'll have somebody get back to you on it."

I looked over the specs on the satellite. It was an odd-shaped object, with solar panels and parabolic antennae sticking out here and there. Good enough.

"Cowboy, how good are you with a lasso?"

"You kidding? If I can *see* it, I can rope it."

"That's exactly what I wanted to hear."

Cowboy floated free, about a hundred meters from *Sundancer*. I stood in the airlock. If this worked, I'd have to jump free in a hurry. About a kilometer of film snaked between us, firmly attached to her suit harness and to mine. The slack served for an elastic buffer. She had a portable radar screen to watch the approach. I softly counted down the

time, trying not to be nervous. "Twelve seconds . . . eleven . . . ten—"

"I have it on screen." Actually, what she was doing only casually resembled lasso throwing. The film was in a huge loop floating in the satellite's path. As I watched she adjusted the positioning slightly to place it more exactly where the radar said the satellite would pass.

"Three . . . two—" The satellite grew impossibly fast, from a tiny bright dot to a tumbling clutter of bright knobs and antennae. It passed in a silent flash and disappeared back into the darkness. I looked at our noose, floating undisturbed by the satellite's passage. A clean miss.

"Sorry, partner," came Cowboy's voice, "Looks like I missed. What do we do now?"

"We hope there's another bronco out there to rope, Cowboy." I triggered the motor to start winding the floating loops of film back on the reel.

The best available was an old SDI satellite whose eccentric orbit had gradually decayed into reach. Control guaranteed that its proximity defenses had long been deactivated. I hoped so.

Unfortunately, it would not pass close enough. The fly-by was only thirty kilometers, but *Sundancer* was now completely out of attitude thruster fuel.

Mission control hadn't thought of any better ideas, though. We took all the gas cylinders we could pry loose from *Sundancer*. Not for air—the oxygen regen on the suits was plenty effective as long as we had sunlight—but for thrusters. Compressed gas makes a lousy rocket, but in a pinch it would be better than nothing. At last we were ready to jump.

Sundancer dwindled into the distance, a misshapen sphere lumpy with telescopes. It disappeared against the gibbous disk of the Earth. I felt sad to see her go. It was an unworthy fate for a fine machine, betrayed by her pilot. "Well, we're committed." I said.

"We ought to be committed," said Cowboy. "This had damn well better work. Else we're in a whole *heap* of trouble."

We were a little past apogee. Cowboy readied the loop of film. Tied to her suit were spare gas cylinders. Using the figures from the portable radar, Cowboy had used her suit thrusters to position herself close to the satellite path, and the tether between us was laid out to nearly its full kilometer length. As I counted down, she gently tossed out her lasso.

The satellite flashed by—right into the noose.

"Got it!" Cowboy shouted. The tether whipped out and snapped taut. "Yee-haw!" Cowboy jerked away, and the film between us began to straighten.

Not fast enough. "Negative!" she said, angrily. "It slipped off."

The stars below began to slowly rotate around me. "I think," Cowboy said slowly, "that we're in a heap of trouble."

We were on opposite ends of a long rope, spinning slowly about each other, darkness and stars below our feet. If I could keep myself from thinking about what would happen as soon as we hit atmosphere, it would almost have been beautiful. The radio faded as the relay

on *Sundancer* passed behind the Earth. We were alone.

"Virginia, you there?"

"Yeah," I said. I didn't bother laughing. "Call me Ginny, though."

"OK. Keep talking, will you? I just want to hear your voice."

"What should I say?"

"I don't care. Just talk."

"OK. Say, Cowboy? What's your name, your real name?"

"Kimberlea. But don't call me that. I hate it. Nobody ever calls me that. In school they called me Lee."

"Oh." Silence. I couldn't think of anything to say. After a while she spoke.

"I don't mind dying, you know? I'm not afraid. It's kind of peaceful out here. The stars swinging slowly past, and all that."

"I'm not afraid of dying either," I said, "but I didn't want to do it right exactly at this minute."

"I hate being alone. I'm a pretty poor cowboy, aren't I? Cowboys are supposed to love solitude. I hate it. I came from a huge family, ten kids. I guess I never got used to being alone."

"So why did you come out here to the big empty?"

"Not for solitude, that's for sure. But out here you're never alone. Packed into a living module with seven other construction crews—hell, you can't even piss in private. Even outside, you're never far away from anybody, and there's always a voice on the radio." She paused. I watched the stars go by. "How did you end up out here?"

I shrugged. "I didn't plan it. It just happened. I was finishing up my dissertation—"

“Dissertation . . . you’re a Ph.D.?”

“Yeah, solar physics. So, I was finishing, and this opportunity came up, and it seemed to be the logical thing. So here I am.”

“Wow. Guess you must be really smart, then.”

“From the evidence,” I said, “Not very. Some are, some aren’t. Some people get through grad school by intelligence, some just by never allowing themselves to give up. I knew a few people who were just astonishingly smart, so bright it was almost frightening. Others were just ordinary people who stuck with it. In the end, I couldn’t see that it made much of a difference.”

“Which were you?”

“A little of both, I guess.” Another long pause.

“What are you thinking about?”

“That there’s got to be a way out of this, if only we could think of it.”

“Oh. One thing you learn out west. Not every problem has a solution. Sometimes there just isn’t a way out. And then you die.”

“Depressing philosophy.”

“Sometimes you gotta take what’s coming to you,” she said. “You know, I just wish you could hold my hand. We’re so close, but so far apart. I just want to be touching somebody. Do you ever feel that way?”

“Yeah.” Well, why not? She was only a kilometer up the tether, and we were spinning so slowly that centrifugal force was only milligees. “Cowboy? Wind in your film. I’ll meet you in the middle.”

“OK.”

At first it was easy. After about a quarter kilometer it felt like the force

was getting stronger. Another hundred meters and it was definitely stronger. The winder motor was beginning to stall. I geared it down to a lower speed and continued winding. Now I had a definite sense of vertigo. The stars below were very clearly *down*, and they were spinning much faster. I geared down again. Two hundred meters apart, and I was trying to pull myself and the spare oxygen canisters up against a full gee. I stopped winding. Above, I could see Cowboy do the same.

“Ginny? Why is the gravity getting stronger when we get closer to the center? Shouldn’t it be getting weaker?”

I looked up the rope, thought about angular momentum, and did a mental calculation. A hundred meters, two gee . . . twenty meters, ten gee. . . . Five meters, forty gee. I explained while I worked it out. “It’s not like the station, where the centrifugal gravity reduces close to the center. It’s like a figure skater pulling in her arms to spin faster. The closer to each other we get, the faster we spin.” There was no way we would be able to meet in the center; we’d black out from the gees first. The slippery satellite had given us too little momentum to save us, but too much for us to ever get together.

Or could we? If we went back down, the suit thrusters and the gas cylinders together might have enough impulse to kill the spin.

No, wait. I wasn’t thinking clearly. Suddenly it was all clear. “Cowboy?”

“Yep?”

“You still have your lasso?”

“Right here.”

“Good. Listen, wind yourself back down to the end of the tether, OK? Then

use the gas tanks and your suit rockets to increase our spin. I'm going to do the same. Got it?"

"Don't you mean to decrease the spin?"

"Negative. Increase it. There may be a way out of this yet." A way out for one of us, anyway, I thought. But I didn't say it.

She didn't ask any more questions. After a while it was done. "OK, Cowboy," I said. "Now lower the empty tank down on your lasso." Now we were three objects spinning—the gas canisters on one end, me on the other, and Cowboy smack in the middle. I cut a five-meter strip of film off my end of the tether to put in my work-pouch, then tied my empty gas cylinders securely to the remaining of the film strip. I left them hanging and began to climb.

After a while the climb got to be dizzying. I ignored it. The stars were spinning faster. I closed my eyes and kept climbing. I started getting lighter. Something grabbed my arm. I grabbed back. It was Cowboy.

We spun around each other. It was dizzying, but there were no gee forces. All the angular momentum was in the gas canisters, swinging on the ends of the kilometer long tethers of high-strength film. I took my spare piece of film and tied one end to myself, the other end to her. Next came the hard part, trying to keep Cowboy from figuring it out too soon. I began winding.

"What are you doing?"

"Pulling in my gas canister."

"You want me to pull in mine too?"

"No. If we wind them both in, we get about a hundred gees. Don't know

about you," I laughed humorlessly. "Me, I can't take that much."

"Oh."

I continued to wind. When the gas bottles were in my arms, I felt a small but significant pull. Cowboy was *up*. I decided not to look down.

"I think I see what you're thinking of. But if one of us is flung *out*, the other has to go down, right?"

Damn. She figured it out. "Right."

"I guess that's better than nothing. What are we going to do, draw lots?"

"No. You go *out*, I go *down*."

"Why?"

"Because it's my plan, and I get to make the choices of who goes where, OK?"

"No. Not OK. You risked your life to rescue me; it's not fair that you should have to sacrifice yourself for me."

"Who said anybody was going to be sacrificed? *Antaeus* is going to be coming up behind and below us. If we stay in this orbit, we reenter before it comes up on us. But if I fling you forward, I get flung backwards, right toward the station."

"Which will have a delta-vee of several kilometers per second."

"Actually under a kilometer per second, but keep in mind that it's spinning. As I pass by, one of the arms of the bolo will be nearly stationary target, and I'll lasso it as I go by. Hell, I'll be home before you will."

She thought about it for a second. "Hey, that sounds good. Except for one thing. *I'm* the one who can throw a lasso. So *I* go down and in; *you* go up and out."

"Yes, but I can calculate orbits a lot faster than you can. I'll need a mid-

course correction. And your suit thrusters are empty. It's got to be me, Cowboy."

Cowboy sounded dubious, but she eventually agreed. As I swung down away from her on my strip of tether, I explained to her the next step.

"OK. Now pull in your cylinder." My apparent weight began to get heavier as the other tank came in and our spin increased. The point was to get as much linear momentum on me as possible. Earth, sun, stars flashed by. Two gees, three. Earth, sun, stars, Earth sun stars. Hang on. Five. Six. Earthsunstars-Earthsunstars. Blood rushed away from my brain. My piezo suit contracted and my torso and legs to compensate, but the world was still getting dark. Seven? Hang on, hang on. Just a little longer. A little more. Don't black out. Time it for Earth to swing by. *Now!* I cut the tether, and blacked out.

I awoke spinning in free fall. I couldn't have been out very long; as I spun around I caught a flash of something disappearing in the distance, and could just convince myself it was Cowboy spinning around the remaining cylinders. Now it was up to her to repeat the maneuver I'd just done, drawing in her gas bottles to increase her spin, then cutting the tether to put them into a reentry orbit, and herself outward as far as possible. I hoped she'd make it.

The plan to lasso *Antaeus* station on the fly was a damn good idea, I thought. It might even have worked, except for one thing—*Antaeus* wouldn't be there. It was behind and below us, all right, but not close enough. After I gave Cowboy enough momentum to put her into

a safe orbit, I wouldn't pass within a hundred kilometers of it. It didn't matter anyway, since I'd used up my suit thrusters the same time she did, spinning-up the tether. Too bad, actually—I'd sounded so plausible, I almost believed it myself.

"Good by, Peggy," I whispered. For answer there was only static. I'd paid my debts, in the only coin that the void would accept.

I drifted through space, waiting for the Earth to reclaim me.

The sling maneuver managed to put Cowboy into an orbit high enough to avoid reentry and let an ion tug make a rescue. She returned to Earth on shift rotation, and I went out to the spaceport to meet her shuttle, along with Jon Wintham, another astronaut. She was surprised to see me. "Ginny! You made it!" She hugged me. "When I got back to *Antaeus* and you weren't there, I reckoned your talk about making it back to *Antaeus* was a ploy so you could sacrifice yourself to save me. God, I am so glad to see you alive!"

My smile was a bit rueful. "Actually, it was just a ploy." She looked at me. "No way I could have made it to *Antaeus*. The maneuver flung me in the right direction, but not anywhere near close enough."

"Then how did you—"

Jon stepped in. "You see, you two were out of radio contact, but as soon as the station came over the horizon we picked you up on radar." I could see Cowboy's startled look as she recognized his voice. He'd been rescue mission control at *Antaeus*. "We could see what you were doing, and eventually we

figured it out. You weren't the only ones who were desperately trying to think of ways to rescue you. Ginny managed to fling herself just far enough backward that we could drop an escape capsule to intersect her course and match speeds."

"And believe me," I said, "Was I surprised to see him!"

"There was no way we could get back to the station, but," he shrugged, "we didn't have to get back to *Antaeus*

anyway. All we really needed was a heat shield and a parachute."

"So you *did* lie to me," said Cowboy.

"In a good cause," I said. "I figured I would pay for my mistake."

"Fortunately," said Jon, "we thought differently."

"I owe you one," Cowboy said.

"With luck," I said with a laugh, "it'll be a long, long time before I have to collect that debt." ■

CLARION WEST ANNOUNCES 1989 WRITERS' WORKSHOP

The sixth annual Clarion West Science Fiction and Fantasy Writing Workshop will be held from June 18 to July 29, 1989 at Seattle Central Community College, with writers-in-residence: Orson Scott Card; Karen Joy Fowler; Lucius Shepherd; Connie Willis; Shawna McCarthy; and Roger Zelazny.

Applications are now being accepted. Approximately 20 students will be selected from the applicants. Tuition until March 1, 1989 is \$995. Late applications will be considered until April 1, 1989 at a tuition of \$1095. College credit and dormitory lodging are available, but are not covered by tuition. Limited scholarships are available. Request scholarship form in advance and return it with your application.

To apply, submit 20 to 30 pages of manuscript (one or two short stories or a novel excerpt with outline) with a cover letter describing your background and reasons for wanting to attend Clarion West, and a \$25 application fee payable to Clarion West. Send to: Clarion West, 340 15th Ave. E., Suite 350, Seattle, WA 98112.

EXTINCTION THEORY

Jeff Hecht



Todd Hamilton

Paleontological evidence is, of necessity, a very skimpy sampling. But some kinds carry a lot of weight . . .

It was all Wasserman's fault. He got me into this; he and his rock samples. I'm a physicist, with some tricks up my sleeve for counting metal atoms. Ask me about single-atom laser photoionization spectroscopy and I can tell you how to get isotopic concentrations and ratios to three significant figures. Ask me about rocks, and I can tell you how to turn them into samples for my handy-dandy laser photoionization spectrometer. Beyond that, all I know is that most of them are grey and have names I never bothered to learn.

I asked Wasserman about rocks. He turned his bleary red eyes to me and picked up one. "This is the boundary clay," he said. "It was laid down at the very end of the Cretaceous, about the time the dinosaurs died out. On top of it are Tertiary sediments. This is a nice little sample," he added, holding up a chunk of rock that looked to me just like any other rock. "I don't know the exact sedimentation rate, but I'd guess that in this two-centimeter thickness we've got the record of a few thousand years." He was in a particularly morose mood, so he added, "Same as from the pyramids to the space age. That's what will be left of us in 65 million years."

Wasserman had been drinking again. He said he drank so much to try to wash away the dust from his field work. He always put down two or three beers when we went out to lunch. I could see the fine edge leave his thinking after the second beer, never to come back until the next morning. I tried to talk with him a couple of times about it, mentioning it gently, but he just snarled that what he drank was his business. I suppose it was, but those of us who have

lived with alcoholics always can see the danger signs.

Despite that, I put up with him. His research grant had paid for a new dye laser, and some very fancy single-frequency optics that could resolve isotopic splittings in the megahertz range. Besides, he didn't show up much. The rocks usually came in from the field, in specially sealed cases so they didn't pick up any contamination. That was necessary because he had us looking for really rare elements—things like osmium and iridium that are down at a part per billion or less. All it takes to make the readings go way off is a finger that's wearing a wedding ring. We learned that the hard way, after one of the grad students got married, and everything she touched came out wrong. Wasserman is scrupulous in the field, or so he says. I've never had any trouble with contaminants, but we never had to look for anything that might rub off aluminum beer cans.

The purpose of it all was understanding mass extinctions, like the one that got the dinosaurs and lots of other things at the end of the Cretaceous, 65 million years ago. Ever since the Alvarezes found too much iridium in that boundary clay, every geologist in creation has been asking physicists how to count isotopes and measure concentrations of rare metals. I get requests for strontium and neodymium isotope ratios, and wish lists that get ridiculous. Everything has its own meaning. The geologists say that strontium isotopes should tell if there was acid rain after an asteroid impact; neodymium ratios vary from ocean to ocean and change with time.

When it started, I just ran the stuff

through the laser, collected the data, and got my name at the bottom of the list of authors. It wasn't a bad way to build up publications. Wasserman gave papers at the big geophysics meetings, and he got into the thick of some of the debates. He argued for the impact theories, but never could convince himself anything was periodic. He told me that he'd seen a statistical analysis that found periodicity in random numbers. Behind his back, I told my grad students that it was his personal experience with the drunkard's walk.

I got into it more when we started running samples from the end of the Triassic, and some of the other major extinction points. Wasserman was selective about his samples; he just wanted certain intervals. Most of the time he went after known extinctions and iridium anomalies. He kept asking for data on more rare elements and isotopes.

"What are you trying to find?" I asked him when he called in from Spain early one morning.

"Patterns," he replied in his most enigmatic voice. The transatlantic phone line was erratic that day, and I couldn't understand most of what he said, but "patterns" echoed back and forth between my ears for the rest of the day.

When he came back from that field trip, he spent two full days staring at my data logs. He had asked me to take isotope ratios for one-millimeter slices of several cores, from well above the boundary clay to well below. All sorts of things varied. The changes were small, but they were real. He scratched his head and walked in circles around the table where he had spread out the readings.

The third day, he came back in the morning as sharp and sober as I had ever seen him. He wanted to brainstorm, and his favorite foil in the geology department was on a field trip.

It might not have gotten anywhere if Karelski, over in chemistry, hadn't gotten a fat contract from the EPA to study pollution deposition in coastal waters. She had taken cores that went back hundreds of years in places like Boston Harbor, then asked me to analyze the glop. The variations were striking. The harbor sediments weren't layered as neatly as Wasserman's rocks, of course, but the trends were equally dramatic. Things like mercury and lead residues rose dramatically with the advance of what we call civilization, then started dropping as pollution controls started. I got to wondering if the lead rose and fell with the use of lead in house paint, and I'd been making a few calls trying to track that.

When I mentioned the similarities to Wasserman, his eyes lit up. Had I run anything similar on his samples? I shook my head. Nor had I tried any of his tests on the harbor samples.

"There must have been so many things happening at the time of an impact," he said. "You get acid rain from the oxidation of nitrogen in the air. You might get lots of carbon dioxide if it hit limestone rock. You'd get huge shock waves from the atmosphere and oceans. You'd get lots of dust. You'd get shocked quartz and carbon particles from fires. You'd have air pollution like you wouldn't believe." He paused, and put his chin in his hands. "You know, there are so many things that could happen that some people doubt anything

could have survived a big enough impact."

It was then I asked the fateful question: "Did it have to be an impact?"

He answered "of course" immediately, then lapsed into silence.

I laid the harbor results in his hands. "Just look at those," I told him. "Swings in abundances every bit as large or larger than the ones we found near the boundary clay. But we know where these came from. People!" I pointed to the start of the rise in the lead curve. "Here's where they started using lead pipes and lead paint. And here's where we figured out that lead was bad stuff and stopped using so much of it."

He had long ago decided I was crazy. Nobody as sober as I am is supposed to have ideas that wild. "But there weren't any people then. You know that!"

"It didn't have to be people. It could have been some other type of creature. Years ago, somebody in Canada suggested that if the asteroid hadn't gotten the dinosaurs, they might have evolved into something intelligent."

Wasserman remembered that. He probably had seen it in the proper scholarly journals; I'd seen it in *Omni*. He had counterarguments, of course. "It was Dale Russell from the National Museums of Canada, and he said it would have taken 65 million years for them to evolve any kind of intelligence. Besides, there should be some trace in the fossil record."

"But we know the fossil record is very fragmentary," I reminded him. He was the one who had told me how tiny a fraction of living creatures are ever fossilized, and how it was hard to find

fossils of small animals. "*Homo sapiens* evolved in only a few million years, and we don't have much record of earlier ancestors."

"Hmmm . . ." Wasserman contemplated. "I will admit that land deposits are scarce from that period. In fact, there's still debate over when the dinosaurs finally died out, but . . . no, it's just too ridiculous. Remember, there were earlier mass extinctions, much further back in the Devonian and Ordovician. You couldn't have had intelligent life then; you barely had anything on land at all. What we're looking for in all this extinction business is a pattern, and what we call 'intelligence' is too new to be part of that pattern."

"Suppose we finally blow ourselves up, like you keep saying we're going to do one of these days. . . ."

"We don't need to blow anything up," he muttered. "If you'd get your nose out of your laser, you'd see people can do a damn good approximation of mass extinction without the bomb. Who do you think got the mastadons and other Pleistocene megafauna? What do you think is happening now in the rain forests?"

I tried to convince him that he was just bolstering my argument, but he would have none of it. The best estimate, he insisted, was that nothing at the end of the Cretaceous had more brain power than a possum. That left a long way on the IQ scale to match people, even in his cynical view.

The closest he could come to my idea was a catastrophic population explosion of some hitherto obscure creature. It might have eaten everything in sight, causing catastrophic population crashes

of other species. It might have excreted something that had dire effects on other living things. One factor in the greenhouse effect that was heating up the globe, he said, was the rapid increase in quantities of methane being farted by cows and rice paddies. Then he reminded me of the iridium anomaly, and dared me to explain it. I said I'd have to think about it.

We went out to lunch, and I kept trying to convince him. Wasserman just kept sipping his beer and smiling. Midway through the third mug, he smiled and looked up at me. "Tell you what," he said. "You sit down and make some predictions of isotope ratios. Then I'll get you some fresh samples to try. That should get this out of your system."

Two days remained before he left for the field again. I turned the laser over to my postdoc and pored through the references in the university library, making a little list. Depleted uranium was on it, with the U-235 removed by some prior inhabitants of the planet to make bombs. The decay of cesium-137 might enrich barium-137 levels, but I doubted we could detect that. I added lead to the list; it got the Romans, so why not somebody long before Rome? But that was about all. No likely products or garbage were likely to last 65 million years. Steel would have rusted away. No matter what the Sierra Club thinks, aluminum and plastics don't last that long. Nor would they leave any obvious signs behind, unless Wasserman hit something he could recognize as a garbage dump rather than an ore deposit. Gold was the only thing that might last that long, but it was so rare there was no sense in looking.

I gave Wasserman a copy of the list. To say he was not impressed would be an understatement. He was cold sober and he scoffed as he read it. "Look," he said, "didn't I tell you where the sediments we found were deposited? Underwater! Most of them came from the ocean bottom. Some came from places near to the shore or even from lakes and rivers, but most that we found were in the oceans. All the stuff you're looking for is deposited on land, and we don't have many land sediments to look at. I'll look, but I'll tell you right now the stuff you're looking for just plain isn't there!"

By the time he was finished, I was ready to give up. I didn't bother to tell him my explanation for the iridium anomaly. I blamed it on beer cans—steel beer cans, made with nickel refined from ores from which the iridium hadn't been removed. I had been all set to get one of the grad students to run steel-can samples through the laser spectrometer. I didn't bother. I laid the notebook full of my crackpot ideas on a pile of trade magazines I wasn't ready to throw out yet. There were other things to do. I started working on my own proposal for trace-element detection to the Department of Energy. I got a new batch of Karelski's samples and went to work. One of my doctoral students had a crisis with his thesis; my postdoc quit to double her salary in industry.

I would have forgotten all about it if it hadn't been for Wasserman. It wasn't the samples he sent in from the field. They never came. The postdoc who had worked with him before would have noted their absence, but her replacement didn't. Nor did I.

He was gone for three solid months. I never heard from him, and I don't think anyone in geology did, either. There were rumors he'd fallen off a mountain in Afghanistan, or been arrested for having alcohol in Iran, but his American Express statements still kept coming. He missed a deadline for filing some paperwork that got the accounting department *very* upset. He was supposed to be teaching a couple of fall courses, and the geology department was about ready to panic about that when he finally returned.

By the time he arrived at my lab, Wasserman had stopped to bathe, shave, and put on some fresh clothes. He had also stopped elsewhere. His eyes were bloodshot, his face burned brown by the summer sun, and his hands were shaking. The summer had aged him, and I had never seen anyone so drunk outside of my family.

"Your little project sent me all over the world," he grumbled in greeting.

I was astounded. "I thought you had—"

"Just because I said it was ridiculous didn't mean I wouldn't investigate it. It was a rational enough idea to test. I didn't for a minute think that there could have been intelligence behind the extinctions at the end of the Cretaceous, but there were plenty of other things happening then, and you'd given me some new ideas."

"You never sent me any samples!"

"They'll come. Slow boat, I'm afraid, but you won't need them now." He patted the sample case in his lap. It was battered and dusty, with a plastic airline ID hanging from the handle. "This should be enough. It hasn't been out of

my sight in a week." He popped open the latch.

I watched in uneasy suspense as he unrolled plastic foam packaging material from the rocks in the case. I had no idea what to expect. I knew so little geology that I doubted I would recognize whatever conclusive evidence he had found to prove that I was wrong.

The rock was grey, with bits of slightly lighter rock scattered throughout the parts that peered above the clean white plastic. The lighter rocks were about the size of broken pencil stubs. "Fossils?" I asked.

Wasserman nodded. "You catch on fast for a physicist. They're bones, 65 million years old. I found them just under the K-T boundary layer in a terrestrial deposit. I was trying to calibrate the time scale of extinctions more carefully. We don't have a good way to tie the extinctions in the oceans with those on land. Some people think they happened at the same time. Others say they were ten thousand or a hundred thousand years apart." He rambled a bit more about people who thought they had found dinosaur teeth shed after the end of the Cretaceous, and why that might not prove anything at all.

I didn't see any pattern to the bones. When he paused in his drunken monologue, I asked, "What do you see in them?"

"What will somebody see of us after we finally kill ourselves?" he grumbled as if it should be obvious. He looked at me, then looked down at the sample and moved the plastic. A glint of yellow metal caught my eye, next to one of the bones he uncovered. I stared at it, trying

to understand.

"It was a ring," he said. "A sixty-five-million-year-old ring. I don't know whose fingers these were, or if they were fingers at all. But it's better evi-

dence than all the isotopes you could count, even if anybody would believe you." He sighed and shook his head, muttering, "I wonder if we'll leave this much behind." ■

FUTURES

(Continued from page 77)

freeze-frame to study O'Brien's effects, and instant replay of any scene.

But more . . . *2001: A Space Odyssey* will be released by Voyager/Criterion this Winter, in wide-screen, digital stereo with an amazing array of documentary material drawn from MGM's archives and private sources.

There are other developments with laserdiscs that make it a medium to watch. Most computer game companies have projects working on CD-I, or Interactive video discs. While some designers, notably Noah Falstein of Lucasfilm, caution that there are still big obstacles to overcome, the interactive video disc has captured the research interest of companies like Activision and Cinemaware.

But one completely interactive disc is available already, using an interface between computer and video laserdisc player. It's called *Frame Up* (IMEDIA International, PO Box 307, Cambridge, MA 02139—Tel. 617-254-0541), and the laserdisc game was originally produced in France. The plot is part mystery, part strategy game. Eddy, the hero of the saga, falls asleep in a department store. He wakes up to find himself locked in and strange things going on. Eddy gets blamed, goes to jail, and only you

can spring him by studying the video record from the store's myriad surveillance cameras, all of them hooked up to video recorders.

Unlike computer games, *Frame Up* uses real actors and settings in a completely interactive adventure. Though financed by a \$1,000,000 grant from the French Government, IMEDIA hopes to make the interactive laserdisc game a consumer product. Currently, it's available for the IBM PC (and its legion of clones) coupled to an industrial grade laserdisc player.

Meanwhile, the Voyager Company is offering something called *The Box*. *The Box* interfaces a laserdisc player and a Macintosh computer, turning any standard video disc machine into a truly interactive tool. Voyager has dozens of intriguing discs that can be studied in a programmed fashion, including a guide to The National Gallery of Art and a series called *Ephemeral Films*.

New laserdisc players are being released, like the Yamaha CDV-1000, that play the entire laser library as well as compact discs and CD-Video, all in digital stereo with over 400 lines of resolution. And an excellent guide to the available films is Douglas Pratt's *The Laser Disc Companion* (New York Zootrope, 838 Broadway, New York, NY 10003), a witty and insightful collection of reviews and commentary. ■

Ben Bova and G. Harry Stine

State of the Art

OVER- COMMUNICATED

What happens when you bring together, in one place, for a one-hour television show the following ingredients:

1. Four authors of science fiction and science fact;
2. A NASA advanced planner;
3. The inventor of communications satellites speaking from halfway across the world;
4. A scientist/author appearing via pre-recorded videotape;
5. Three science fiction artists from three different locations in the U.S., sketching via slow-scan video;
6. A crew of 17 scientists wintering-over at the South Pole and speaking via satellite;
7. Thousands of people from all over the world asking questions of the authors in the TV studio through their personal computers linked via the in-

teractive CompuServe computer network; and

8. Video/computer technology that allows an entire chapter of a book to be transmitted by television in a thirtieth of a second.

Answer: You get speed-of-light data overload!

The television program took place 22 October 1987, in the East Lansing studios of Michigan State University's WKAR-TV Public Broadcasting station.

Authors Ben Bova, Charles Sheffield, G. Harry Stine, and John Stith were present in the studio, together with NASA planner Jesco von Puttkammer. Arthur C. Clarke spoke with them from his home in Sri Lanka. Author/scientist Robert Forward spoke by videotape. Artists James Christiansen, Don Maitz,

and Michael Whelan participated from their homes.

The program was called "Science Fiction/Science Fact" or simply "SF²." Its real purpose was to investigate the potentials and problems associated with a combination of all the communications technologies now available via satellites and computers. Such technologies will become even more common in the 1990s once NASA launches its Advanced Communications Technology Satellite. ACTS will serve as a "switchboard in the sky."

SF² was the brainchild of Dr. Carrie Heeter, director of MSU's Communications Technology Laboratory, and John G. Bluck, Deputy Director of the NASA Lewis Research Center's Educational Services Office. ACTS, a NASA Lewis program, will be able to handle ten times more data and information than existing communications satellites. It will make possible "electronic field trips" for students.

Heeter and Bluck wanted to find out what the potentials and problems of such advanced communications capabilities would be. Using the limited resources of today's communications satellites, the hour-long show was uplinked from MSU's studio via transponder 12 on the WESTAR IV satellite, and offered free to any PBS station wishing to rebroadcast it, as well as to anyone with a home satellite antenna capable of receiving WESTAR IV.

There were also thousands of subscribers to the CompuServe computer network who participated in the show through their personal computers.

The actual show was a true blend of

science fiction and science fact. Clarke discussed the novel he was writing from his home in Sri Lanka where it was 5 A.M. Despite the swiftness of satellite communications, not even science fiction writers have found a way to get around the clock. The 17 scientists at the South Pole compared their quarters to a base on the Moon or Mars.

But it was literally impossible for the five author-panelists on camera in the studio to handle all the data inputs.

While they were speaking to their distant guests or discussing science fiction topics among themselves, those thousands of CompuServe networkers were sending in questions that scrolled across the video screen and were gone before anyone had a chance to answer them.

The show's theme of science fiction and science fact seemed a natural. The authors who participated, either live in the studio or remotely, were all involved in the genre of literature that has been for the past sixty years exploring future scenarios and the impact of technology on people. Each of the authors also had distinguished careers in various aspects of scientific research or technology.

But as NASA's Jesco von Puttkammer pointed out, science fiction has not always hit the nail squarely. "In all the first Moon landing stories ever written, science fiction never foretold the simple fact that mankind's first step on the Moon would be witnessed by billions on Earth through the medium of television."

The authors in the studio were supposed to address the following topics:

What is the function of science fiction

in society?

Does science fiction influence science?

Science fiction as modern myth.

Science fiction as an awakener of ethical awareness.

Can science fiction prepare people for change?

Does science fiction act as a crystal ball?

The authors on the studio panel could have spent hundreds of hours discussing these topics alone. Instead, they were overwhelmed by the technology that bombarded them. It was a situation that TV personality Hugh Downs once described as "overcommunication."

Overcommunication can happen to anyone. Sometimes the results can be fatal. It is most apparent in the control rooms of nuclear power plants and cockpits of jet airliners. It has led to the emergence of the science of ergonomics: designing systems and hardware for easy, efficient use by human beings.

Each of the authors participating in the SF² program had written about ergonomics long before it was called by that name. But none of them had experienced the information overload that deluged them in the MSU studio. While CompuServe questions, video pictures, and audio conversations came in from all quarters of the globe, the author-panelists were able to handle only one item at a time. The technology far outran the linear response capabilities of the panelists on camera.

Sketches by Whelan or one of the other artists were being shown while the authors were chatting with the scientists at the South Pole. Simultaneously,

CompuServe questions were scrolling across the bottom of the TV screen.

Most of the questions came and went before anyone could even read them. Discussions among the author-panelists were interrupted by the call to Sri Lanka (you don't keep Arthur Clarke waiting at 5 A.M.). Forward's videotape presentation was squeezed in while still more questions poured in from the computer network. Good questions, too.

And the panelists never got the chance to discuss all the topics on their pre-show agenda.

The technology was there, and it worked fine. The human techniques for using the technology adequately were lacking. But that is what experiments are for: to test ideas. And SF² was an experiment.

One interactive CompuServe part of the experiment was a decided success. The panelists in the studio asked the audience: "Has science fiction helped you gain a better understanding of the modern world?" Before the hour was out, 96% of those answering said YES.

Another success was the "burst" transmission of a chapter from one of Stith's books over ordinary television: viewers could record the thirtieth-of-a-second transmission on their video cassette recorders, then connect their VCRs to their home computers and have the entire chapter reprinted. At that speed of transmission, *War and Peace* could be sent through TV in a few seconds.

In a debriefing critique after the show, Dr. Carrie Heeter asked the authors for comments. The analogy everyone agreed on was that of the puppy chasing an automobile. The car is much

faster and larger than the pup. So what is the little dog going to do when he catches the auto?

SF² showed that it is possible to achieve the electronic global village that McLuhan and other pundits have foretold. The technology exists today and

will be commonplace in the 1990s.

Now we must learn how to use the technology, how to match the linear programming of the human brain to the widening horizons of modern communications technology—without falling prey to overcommunication. ■

HOW TO TELL TIME TRAVELERS

Ruth Berman

1. They all have runny noses all the time.
(The local viruses are always different.)
2. They talk funny—
The accent's always a trifle off,
And they're not so hot with slang.
3. They all have sore throats.
(The local viruses are always different.)
4. They get this smug
Had-you-but-known look
Any time you say
What you think is going to happen,
And they won't tell you what will.
5. They all have diarrhea all the time.
(The local viruses are always different.)

Look for them
In the over-the-counter remedies section
Of your drugstore,
Having trouble making change.

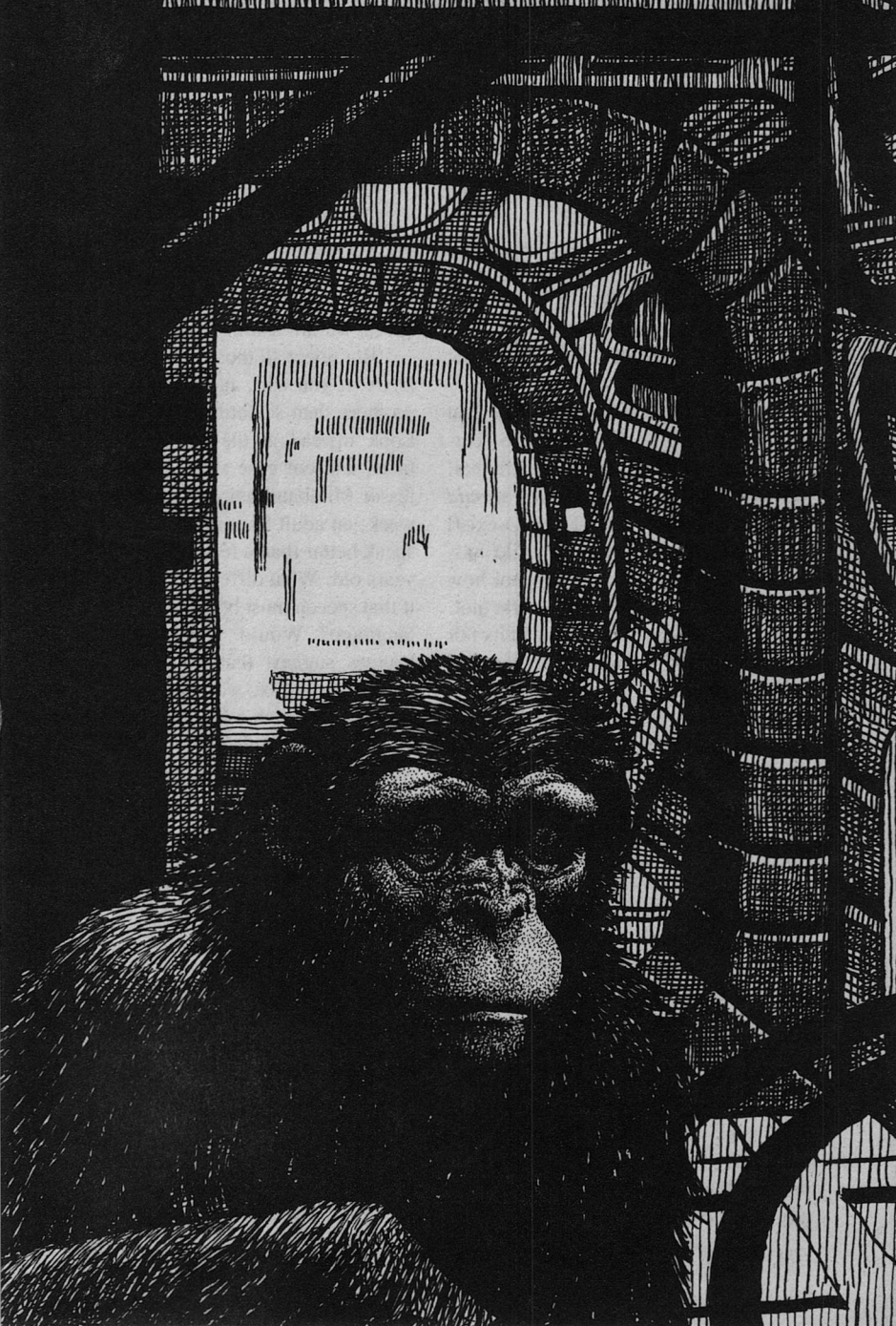
HUMANITY TEST

Charles Sheffield

Motive is usually a key element
in establishing guilt or
innocence—but sometimes its
importance goes far beyond that.

Janet Aulisio





"In the past few days we have heard a great deal of talk about the *origins* of the Shimmies. It has been stated—several times—that Jakob Schimmerhann's actions were completely illegal; that we all know this to be the case, and that he richly deserves punishment.

"Very well. Suppose that we admit it. His actions were certainly illegal. The use of human DNA in genetic experiments was and is strictly forbidden. Some form of punishment is surely not inappropriate.

"But now let us go on, and admit that the origin of the Shimmies has no bearing at all on the findings of this tribunal! Whether or not the Shimmies *should* exist is quite irrelevant. They *do* exist! When we ask what rights a child has, do we ask who its parents were, or how it came into the world? Of course not. Once a baby is here, we insist on its fair and humane treatment. Origins and rights have little to do with each other.

"*Prove* the Shimmies are human, says counsel for the defendant. But no one has ever devised a foolproof humanity test. Genetically speaking, we are told, a Shimmy is closer to a chimpanzee than he is to a human, since Jakob Schimmerhann used less than one tenth of one percent of human DNA sequences in creating the Shimmy form. The defendant therefore suggests that a Shimmy is only one thousandth part human. But what is left unmentioned is that we—humans and chimpanzees—share 99 percent of our DNA sequences! Humans and chimpanzees are close cousins. The Shimmies are closer to us yet. So when the Attarian Corporation claims, in their use of Shimmies as slave laborers—"

"Objection. Your honor, the term 'slave laborers' is an inappropriate one to describe working animals, which the Schimmerhann chimpanzees are, in our contention."

"Objection sustained."

"I withdraw the term. I will say that the differences between humans and Shimmies are mainly the superficial ones of appearance, but in all real respects we are astonishingly close.

"But reject all those arguments about DNA, if you will, and say that they are no more than scientific mumbo-jumbo. Look instead at the bald, undisputed facts, and our case still holds. As Professor Miraband pointed out earlier this week, an adult Shimmy can speak, and speak better than a human child at three years old. What difference does it make if that speech must be done through sign language? Would my honored colleagues suggest that a human person without a larynx, who must also communicate through sign language, ought to be stripped of his or her human rights for that reason? Or that a human child of three, who happens to be sick, may be put down for convenience? It is just as wrong to murder a Shimmy—"

"Objection. The term 'murder' is not appropriate to describe the death of an animal."

"Objection sustained. Counsel, please employ a terminology that bears less semantic loading. I am sure you are able to do so."

"Yes, your honor. I repeat, would a human child who was sick, or a human unable to communicate by speech, be mistreated, or killed? Of course not. Even the suggestion is ludicrous.

"And when it comes to manual skills,

or the ability to follow direction, or—let us be quite explicit—the ability to *think*, our last witness made it very clear: an adult Shimmy surpasses the average human child of four years! Would you agree that a four year old has no human rights? If there happened to be an excess of four year olds, how do you react to the idea that their numbers be reduced? And yet that is exactly what could happen to any Shimmies, until their rights are established and protected.

“I say in conclusion, we are asking for full rights. But we are not talking animal rights here, we are talking *people* rights. Those rights for the Shimmies are not merely due, they are long overdue. It is immoral and it should be illegal to treat them as animals. They must be treated as *people*. They *are* people. Our case rests.”

Leon Karst was smiling as he nodded to the trio on the tribunal—one woman, two men—and resumed his seat. But Sally Polk could see that he was sweating. Karst had told Sally that the first week was crucial: “We make our case on direct testimony, not on cross-examination. By the end of the week we need to have the tribunal persuaded, and make sure the other side is staggering.”

If he was right—and Sally had seldom found him wrong—then this case was by now won or lost. Sally glanced around the packed court room, then looked up at the tribunal, leaning back in their seats after nearly thirty hours of testimony. As a new junior it was her first time in court. She tried to read their expressions. Dean Williams, the retired judge, was inscrutable. He wore a polite, remote expression, as though his mind was somewhere else. But the pre-

cision of his questions proved that was far from true. It was merely that his face gave nothing away. The man and woman flanking him were perhaps easier. Richard Kanter was a shrewd, dark-haired, out-of-condition lawyer from the mid-west, and he was nodding slowly, clearly approving of Leon Karst’s summation for the plaintiff. Laurel Garver, youngest of the three, and sitting to Judge Williams’s right, was leaning across to speak earnestly in his ear. Through the whole week she had seemed sympathetic to the case that Karst was making on behalf of the Shimmies.

Judge Williams listened carefully to Laurel Garver, nodded, and leaned back in his chair. “We’ll have to resolve that later,” he said. Then, to Leon Karst and his counterpart on the other side, “Unless you have procedural matters to take care of, the tribunal is adjourned until nine o’clock on Monday morning. Do you have anything?”

Sally stared at the lawyers for the other side. All of them had been no more than names and reputations on Monday morning. Now she had a strong feel for each of them. Deirdre Walsh—the famous Deirdre Walsh, chief counsel for the defendant—was shaking her head in reply to Judge Williams’s question. From her record and Leon Karst’s comments, she had to be tough, smart, and ruthless. She showed no sign at all that she was ready to give up on the case, but Sally would never have known of her toughness from her manner in court. Deirdre Walsh was conservatively dressed in a trim blue-grey business suit, set off by a wisp of blue lace at the throat and a sprig of fresh lavender on her lapel. She seemed friendly and

quiet-spoken. ("But wait a bit," Leon Karst had told Sally a couple of evenings ago. "Next week she'll show her teeth." He sounded pleased at the prospect. The press coverage would peak during the second week of the hearings.)

"One small point," Karst was saying now to Judge Williams, "we will need to know the names of Monday's witnesses."

This was an important moment. The tribunal did not meet over the weekend, but no one pretended that it was a time for rest. The three tribunal members would be reviewing the evidence presented during the week, then meeting at meal times to discuss the theory of the case. Deirdre Walsh and her assistants would be combing the transcripts of the previous week's testimony, looking for any material that helped their case; and Leon Karst, with Sally's help, would be deciding on the line of cross-examination for the first witnesses produced by the defendant. Each afternoon at close of business, the side whose case was being presented finally provided the names of the next day's witnesses; each evening, the other side desperately prepared cross-examination materials.

"We will have only one witness on Monday." Deirdre Walsh sounded casual. "That will be Captain Russell Grenville."

There was a great buzz of conversation through the court room. Leon Karst grunted in surprise, while Sally puzzled over what was happening. She knew Grenville's name—everyone did—but it had not been mentioned before during all the preparation for the Shimmy rights' case. Surely that meant he could not be offered as a witness?

Karst was on his feet again, speaking through the din. "Your honor, no one has previously offered Captain Grenville as a potential witness. He is therefore ineligible."

"Quiet, please." Judge Williams inclined his head towards Deirdre Walsh. "Counsel?"

"Normally, yes," she said. "But let me remind my honored colleague for the plaintiff of the legal code, as established following *Rost v. Watkins*. 'In the event that a potential witness is off-Earth, and the time of the return of such witness cannot be guaranteed in advance, then such witness may appear without prior notification, with cross-examination postponed upon request of counsel for an added twenty-four hours.' That applies exactly to Captain Grenville."

"Is he on Earth now?" asked Laurel Garver. "For the code you cite to be applicable—"

"He is not. But he is on the way. I can guarantee that he will be here, in this tribunal, on Monday morning."

"Then the witness is approved. Any more discussion?" Judge Williams glanced around the room, smiling for the first time in a week. "Very well. Court adjourned."

The cross-referenced data base yielded masses of information about Captain Russell Grenville. Too much information. Sally Polk had to boil it down to something that could be summarized and used.

Commander of *Sunskimmer*, and the first human to lead a landing party on the surface of Mercury. Tsiolkovskii Medal winner. First human to take a

ship through the rings of Saturn. Congressional Medal winner. First human to lead a party surviving an encounter with Karkov's Object. Explorers' Club Award for Gallantry. First human to return volcanic samples from Io. Dae-dalus Award . . .

The list went on for pages. Nothing to grab on there. Grenville's reputation as a commander and a leader was pure gold.

She keyed to personal data. Unmarried, but apparently heterosexual. *No long-term relationships*. She underlined that mentally, for possible future reference. Religious, high-church Episcopalian, but no evidence of extreme views. From a moderately wealthy family, two brothers, one an army general, one a successful businessman. No evidence of financial problems, or even of much interest in money. Politically conservative, consistent with the family's background (in Sally's experience, only very rich families were liberals — *moderately* rich ones ran conservative).

She stopped fiddling with the cursor control, and leaned back in her chair. It was nearly ten o'clock, and still she had nothing useful for Leon. Russell Grenville's personal data matched his public image. Everything in his political, religious, and financial history spoke of a solid, conservative outlook on life, the profile of an upright, rigidly moral man with a strong Calvinist streak—and a tough witness. It would not be surprising if he preferred to think of the Shimmies as animals rather than humans. But there had to be more to it than that. There were billions of people on Earth who shared that opinion. Why would Deirdre Walsh drag Captain Rus-

sell Grenville back from wherever he was, back at vast cost from somewhere in the middle of nowhere millions of miles from Earth, unless there was something more?

Sally sighed and went back to the searches. Just where had the defendant's lawyer dragged him from?

The Egyptian Cluster. Thirteen months ago he had set out on an expedition to the region of the Egyptian Cluster, to catalog and assay outlying members.

Sally pulled in a cross-reference. She had been right, it really was the middle of nowhere. The Cluster was an odd little group of asteroids, with orbits different from anything else in the System. 'The common plane of their orbits lies at sixty degrees to the ecliptic.' What was the *ecliptic*? Another ten minutes went into answering that, but she had no choice. Leon Karst had a rule: 'Never ask a witness a question if you don't know what the answer will be. And never bring me a fact you can't explain—because I may have to explain it to a judge and jury.' A year with him had taught her he wasn't joking.

She read on. It was time-consuming and very expensive in fuel to visit the Egyptian Cluster. The only sizeable colony there was a fifty-person mining outpost on Horus. Had Grenville intended to visit Horus itself? Somewhere in the general data bases there ought to be his complete flight plan.

She wriggled her way through the reference banks, hopping from one index to another. In another half hour she found the mission profile. She had intended to inspect the flight plan, but before she did that she took a look at

the manifest. What she saw there sent her hurrying off to find Leon Karst.

"It's half the story." Leon Karst went through a vitality dead spot between eight and nine at night, but once clear of that he was ready to work until dawn. Now he had his second wind. "So Grenville had half a dozen Schimmerhann chimps on his ship, as part of his crew. And he objected to their presence."

"I've got Richard digging for an actual copy of that objection."

"Quite right, we have to for completeness. But I don't have great hopes. It'll be a formal thing. Hell, no matter what he says about the Shimmies, it wouldn't justify dragging Grenville all the way back here on a hyperbolic orbit—don't bother to look it up, I know what it means, it says you have to spend money, lots of it, to get from here to there." He was frowning at the projection screen, where the crew and manifest of Grenville's ship were listed. "I'm telling you, Deirdre Walsh has something else up her sleeve. Something to do with Grenville and the Shimmies on his mission."

Leon Karst was married, with three children. Sally had heard him talk of his family dozens of times, but he never spoke his wife's name with half the intensity that he said "Deirdre Walsh."

"If she didn't have something special," he went on, "she'd have called by now, suggesting a week-end meeting and maybe an out-of-court settlement. I've been watching the judge and the rest of the tribunal, and they're sold on our case. We did really well last week. Deirdre sees the way the river flows as

well as I do. She ought to be crawling here on her belly. And since she's not . . ."

"What next?"

"We'd like to find out what happened on Grenville's ship. I already put in a call to Phil Saxby, over in the USF, but there's a blanket silence on anything to do with that mission. We know where they went, and who went, and that's all. I don't have the right level of insider. Did you know that Deirdre Walsh's brother works for the USF, up near the top? No need to guess where *her* information comes from. The only thing I found out for certain is that Grenville won't arrive on Earth until Sunday night. No chance for us to get anyone in to see him before he testifies."

"So you can't find out what's been happening?"

"I'm going to find out, all right. I'm going to find out when Captain Russell Grenville, damn his Navy breeches, stands up in court at nine o'clock on Monday morning and tells me and the rest of the universe." Karst glared at Sally. "You thought you saw newsmongers today. Just wait until Monday morning, Sal. We'll be able to paper the walls with press credentials."

Sally thought at first that she was seeing anger. Only later, flopping into bed at nearly 4:00 A.M., did she recognize Leon Karst's expression. He was full of a vast, visceral excitement.

By Sunday afternoon even Leon Karst was ready to admit they had done all they could by way of preparation. At Sally's urging he allowed himself to be dragged along to the old Virginia estate, twenty miles west of the city, where the

Animal Rights League had their headquarters. It was his second visit, and her twenty-fifth.

To Sally, the hundred-acre wooded lot always felt more like a prison than a non-profit organization's main facility. There was a tall fence of thick chain-link, a line of electrified wire along its top, and the entrances were guarded by heavy metal gates. The men and woman on duty carried electronic communications devices and stun-guns.

Perhaps not a prison, thought Sally, as they passed inspection and were ushered through by the uniformed guard. More like a beleaguered fortress, maybe.

Almost at once they saw the first Shimmies, wandering freely through the woods in the mild October sun. Leon opened the car window and stuck his head out to stare at a group of five walking along the grass verge.

"They look just like chimpanzees, don't they?" he said. "I know they're a little taller and heavier, but you don't notice that from here."

"That's part of the problem," said Sally. "If you don't know Shimmies, and you haven't interacted with them, you can't help thinking of them just as chimps. In fact, for all I know, that is a group of chimps. It's hard for us to tell the difference. That makes people uncomfortable."

"You bet it does. Once we get the Shimmies their rights as humans—and we will, Sal, no matter what Russell Grenville says—then we'll have a new problem. How will the average person know if he's dealing with a Shimmy or a standard chimp? And you know where *that* will take us. Right where the Animal Rights League wants us to go."

"They say that ordinary chimps are smart enough to deserve full rights, too. Did you know that there are chimps on the West Coast with a working vocabulary of four hundred words?"

"Yeah. And gorillas." The car stopped, but Leon stayed in his seat. "And orangutans. I'll say this before we get inside, Sally. We're going to do our damndest to win this case, but the problem with *all* cases like this is that they never end. There's always a beginning. We'll have full rights for Shimmies, then it will be human rights for chimps, then rights for baboons, then rights for dogs and cats. These people will never stop. And if you think I'm going to stand up in court, and plead for rights for oysters . . ."

You might, Leon—if Deirdre were your opposition. But Sally said nothing.

The inside of the main building had a strange smell, like a cross between a hospital and a zoo. Leon Karst wrinkled his nose. He had come along to humor Sally, but he did not pretend to be comfortable.

"Intellectual commitment to a client is right, Sally," he had said, when the case began. "In fact, it's absolutely essential, even if it's a *pro bono* case where we don't get paid. But *emotion* for a client's cause is the worst thing you can do for them. It clouds your judgment. That's why I don't think it's a good idea to spend too much time with the Shimmies."

But he had not objected when Sally made regular visits to this facility. She felt that she had to understand for herself just how intelligent a Shimmy might be.

It took a while for her to realize a basic truth: Shimmies were as variable

in their intelligence as humans. In a population at the Animal Rights League headquarters of about six hundred, Sally had met Shimmies who could sign for food and water, and little else. But there was also Skeeter, a female Shimmy who knew the name of every human in Headquarters, who loved to make jokes and puns in Ameslan, and who seemed to catch on to ideas as fast as any human. And Skeeter was still immature, still developing.

She was waiting for them just inside the door. Sally recognized her, even without the identifying color-coded waistband. The Shimmies saw no point in wearing clothes, but many of them found it convenient to hang a carrying pouch on their belt.

"Hello again," Skeeter signed, slowly, knowing the limits of Sally's mastery of sign language. "Say hello Mr. Karst from me. How case going?"

Skeeter was all chimp, except for the expression in her brown eyes. That expression, to Sally, made her all human.

"It went well last week." She spoke very slowly and clearly, though in Skeeter's case that was hardly necessary. "But tomorrow the other side begins their case. We do not know what they will say."

"Wish I there." She gave the sign for humor. "Be witness."

Sally smiled back, and turned to Leon Karst. "Skeeter says she wishes she could appear in court, too, and be a witness for us."

"Sure. Tell her—" Leon paused and shook his head. He smiled at the Shimmy. "Sorry, Skeeter. I forget that you understand. I wish you could be a witness,

too. It is a flaw in our legal system—a bad piece of our system. Until you have human rights, you cannot be used for a witness, even though your testimony is just what we need to guarantee you those rights."

"Say, I understand." Skeeter signed to Sally. "Mr. Karst not comfortable here, right? Tell him, we all thank his work. Know he win for us. Take him now, keep his thinking happy for tomorrow."

And if *that* isn't human (or super-human) sensitivity, thought Sally, then I don't know what is. "We have to go upstairs first, Skeeter, and talk to general counsel—"

"Who 'General Counsel'?" Skeeter spelled the words out, syllable by syllable.

"General counsel is top lawyer for the Animal Rights League. He'll want to know what to expect tomorrow."

"Me too. Good luck."

"Thank you." Sally returned the sign for 'Good luck'—one of the few dozen she could make with confidence, and led Leon towards the elevator.

And since we don't know what to expect tomorrow, she thought, we need all the luck we can get.

Leon Karst had been right on almost all his predictions. Neither Sally nor anyone else in the office had been able to learn more about Russell Grenville's mission to the Egyptian Cluster, or its outcome. A check at the Wallops Island spaceport on Sunday evening revealed only that Grenville was expected there about midnight, and would be driven to the tribunal in time for the Monday hearings. Deirdre Walsh did not call at any

time during the weekend, to propose settlement negotiations or for any other reason.

But on two points, Leon Karst proved dead wrong. First, Captain Russell Grenville did not stand up in court on Monday morning. He could not.

The courtroom was filled to capacity by 8:30. Judge Williams and the other two tribunal members were in their seats by 8:55. At 8:59, the doors to the chambers occupied by the Attarian Corporation and their legal counsel opened. Two men entered. They were carrying a flat padded table between them. On that table, upright, was Captain Russell Grenville. He was held by a harness at chest and midriff. He was armless and legless.

The broad head and the full beard were unmistakable. But the heavy shoulders no longer supported well-muscled arms, and the long, strong legs had been removed at the hips.

And contrary to Leon Karst's prediction, Russell Grenville did not begin his testimony at nine o'clock. The screams, shouts, and general chaos that erupted at Grenville's entry took fifteen minutes to subside. One woman and one man fainted, and had to be carried out; another three were forcibly ejected, shouting unintelligible slogans. Sally could not tell which side of the case they were on.

In the middle of the confusion, Leon Karst leaned over to her. "That's the way you do it, if you're Deirdre Walsh." He spoke in a low voice, but he could have shouted without drawing attention. "You see, it doesn't *matter* what Grenville says now. He has the sympathy of everyone in the courtroom, even the tri-

bunal members. They'll try to be objective, but they're human, too. Bang goes our case."

His eyes were gleaming—with admiration, not emotion. (Sally remembered what she had been told when she first came to work. "Leon leaves his emotions outside the courtroom. He has a guiding principle there: 'What counts in legal practice is honesty, decency, and sincerity. As soon as you learn to fake those, you have it made.'")

"What can we do, Leon?"

He shrugged. "Lie low. Listen, watch, think. But we may be dead in the water. Unless something new comes up, I'm not a big enough fool to cross-examine Grenville."

Sally realized just how carefully Grenville's appearance and testimony was being managed when order was finally restored and it was time to swear in the witness.

Deirdre Walsh turned to the judge and said simply, "Your Honor, Captain Grenville has never told anything other than the truth. I hope that is enough." She left it to the audience (and the tribunal) to realize that the usual practice of the witness raising his right hand for swearing in was impossible here.

Russell Grenville held his torso upright on the cushions. If what had happened to him had affected his mind, it was impossible to tell that from his face.

"Captain Grenville." Deirdre Walsh began quietly, speaking so softly that the courtroom stilled to hear her. "Let me first ask you to confirm certain details of your personal history."

She began to list his accomplishments, the same ones that Sally had read two nights before. It took many min-

utes. Russell Grenville said no more than "That's right," or "That is so," as he was asked for confirmation of an event or an award. But at the end, there was not even a whisper in the courtroom.

"Very well," said Deirdre Walsh at last. "Now I would like to ask you certain questions about your most recent expedition. Would you agree, Captain Grenville, that this was not supposed to be a particularly dangerous mission? That perhaps the participants of that mission were rather more worried about possible boredom than about catastrophe?"

"Solar System exploration always has an element of danger." Grenville's voice was calm and rational, and yet its utterance from deep within his chest somehow made the listener more aware of the truncated body around it. "However, I would agree that I did not see peril as the major element of the mission."

"And for that reason, you permitted a group of Schimmerhann chimpanzees to be included in your ship's crew?"

"I did."

"But it would be fair to say, would it not, that you objected to their presence?"

("She's leading him!" whispered Sally.

"She sure is," replied Leon Karst, just as softly. "But there's times you object, and there's times you don't. For the moment, we keep quiet.")

"I objected very much. Orally, and in writing." For the first time, there was an element of feeling in Grenville's voice.

"Would you mind explaining to the court the basis for your objections?"

"I would not mind at all. The ship that I was commanding, the *Poseidon* of the *Hecuba* series, calls for eight crew members and a central command computer. That is ample to permit efficient operation of the vessel. There is plenty of space, but ideally that should be reserved for cargo. I was asked to add to the usual complement of crew six Schimmerhann chimpanzees, and to evaluate their possible use in the space environment. I stated, orally and in writing, that it was my task to undertake a serious mission, with serious objectives. I had no interest in managing a spaceborne zoo, whether of Shimmies or anything else."

While the courtroom buzzed with excited reaction, Leon Karst turned to Sally and shook his head. "I know," he said softly. "We could object to the implication that Shimmies belong in a zoo. But this isn't the time for it."

"You allowed the wishes of your superiors to override your better judgment?" went on Deirdre Walsh, as the hubbub died down.

"I am a member of the Space Navy. As such I believe that we are all better served by the obeying of orders, rather than the following of individual whim. Any naval officer who feels otherwise ought to resign his or her commission."

In other words, said Sally to herself, I did it because it was my duty—not because I thought that it was a good idea. The packed courtroom was again dead silent.

"Tell us now, if you will, about the trip to the Egyptian Cluster. The six Schimmerhann chimpanzees were with

you for over a year. Did you learn to work with them during that time?"

Grenville hesitated for a moment. "Yes, we did. I personally, and several of my crew. But not in the way that we had expected before the trip began. The crew resented the idea that they ought to learn Shimmy sign language. I did not feel it was my task to insist that they should. The Shimmies understood verbal commands—"

"Simple verbal commands?"

"Simple verbal commands, exactly." (*That's right, Grenville, said Leon Karst, just loud enough for Sally to hear. Stick to the script.*) "Enough to carry out simple shipboard duties. And one of my crew members devised a system using a video camera and the ship's main computer, that allowed sign language gestures to be translated into audible form."

Judge Williams leaned forward. "Excuse me, Captain." His voice was friendly, almost deferential. "Do you mean that, by a Shimmy making gestures into the camera, some sort of dictionary of gestures was stored in the computer and used to generate spoken language equivalents?"

"Exactly, Your Honor. I should point out that this called for considerable changes to the standard Shimmy sign language, in order for the computer translation to work. But there was plenty of time to work on that. By the time that we had been in space for nine months, the system had reached a satisfactory form. I could use it, though I was not our expert."

"And by that time, what were you doing?"

"We had reached the outlying members of the Egyptian Cluster, and we

were busy with assay work. A number of the smaller bodies contain high-grade deposits of valuable minerals, but they had never been inventoried. We spent the next two months on that work."

"And the Schimmerhann *chimpanzees*"—as always, the counsel for the Attarian Corporation emphasized the last word. She never referred to them as Shimmies—"were they used in this assay work?"

"By no means. That work calls for scientific training. I would entrust it only to my crew." Grenville hesitated, then added: "However, occasionally one or two of the Schimmerhann chimpanzees would accompany crew members in the pinnace. That is the small free-flying exploration module that was housed in the main ship—"

"But the Schimmerhann chimpanzees had no active role to play, did they?" interrupted Deirdre Walsh. Sally had the feeling that Grenville had been moving onto unrehearsed ground. She made a note for later discussion with Leon Karst.

"Not in the assay operation. Nor in the operation of the pinnace. They were there, if you like, as supercargo."

"Very well. Now, Captain Grenville." Deirdre Walsh dropped her voice a tone. "Now we must come to something that I know will be a very painful memory to you. Would you please describe to this court the final terrible hours aboard your ship, just as you remember them."

"Very well." Grenville cleared his throat. When he continued his voice was perfectly steady, but nonetheless a shiver of anticipation ran through the courtroom.

"We had examined a small fragment co-orbiting with Bast—that's one of the bigger Cluster members, eleven kilometers in mean diameter. We were ready to head for Atmu, and on the way I was proposing to pay a visit to Horus and drop off medical supplies to the mining colony there. It was early in our working day. I, and three of my crew members, were in the forward part of the ship. The other crew bunked aft. The Schimmerhann chimpanzees were all midship, in a modified cargo compartment. I was initiating the control sequence for an in-space attitude change, ready to direct us on a low-thrust approach path to Horus, and as I was leaning over the control board I was struck a violent blow on the back of the head."

Grenville lifted his face to the ceiling, and rolled his head back and forth from shoulder to shoulder. Sally Polk felt that what Grenville really wanted to do was rub at the back of his skull with one vanished hand.

"I began to turn, but before I could get more than halfway round I was hit again, even harder. That knocked me cold."

"What else do you remember of events inside the ship?"

"Inside the ship? I remember nothing. My next memory is of waking in the emergency medical facility on Horus. Two of my crew were with me. We were all—like this." Grenville turned his head, to look at the empty jacket sleeves.

"Where are those crew members now?"

"They are still on Horus. In due course they ought to be brought to Earth. We will all be fitted with pros-

thetics. I am told that these days they can do wonderful things with prosthetics."

"The other two are expected to survive?"

"Oh, yes. We will all survive. Unfortunately."

The impact was in his words, not in his calm tone. Sally felt sick. A few weeks ago Russell Grenville had been a complete man, healthy and powerful. Now . . .

"What happened to the other crew members?" said Deirdre Walsh gently. "And to the Schimmerhann chimpanzees?"

"I am not sure. This can be only a conjecture." Grenville nodded at Leon Karsh, forestalling any possible objection. "But it is, sir, a conjecture based on good evidence. First, we arrived at Horus in our little pinnace, not in the ship. It's a miracle that we made it at all, because we were down to our last dregs of power. The main ship itself has not been found, although a search is being made for it throughout the Egyptian Cluster."

"So could the other crew members perhaps be alive on that ship?"

"Absolutely not. We each wore life-support beacons, transmitting on selected frequencies and with coded identification signals. They function as long as their wearer is alive, and they have enough power for years of operation. The other crew members are dead."

"And the Schimmerhann chimpanzees. Did they also wear beacons?"

"It was not considered necessary. Or appropriate."

"So the Schimmerhann chimpanzees might still be alive?" Deirdre Walsh

glanced across at Leon Karst. "Before my honored colleague can object to that question as leading or conjectural, let me ask Captain Grenville to comment in his own way."

"Thank you, Counsel," said Judge Williams. But the reproof in his tone was mild.

"They might certainly be alive," said Grenville. "But it's my bet they are all dead. One of them certainly is. We had been having some discipline problems with all of them for a week or two. They didn't like some of their assignments, and they were doing a sloppier and sloppier job. I think they became angry when they were chastised, and so they attacked without warning. I feel sure they put my crew out of action and gained the run of the whole ship. They killed some, and then did—what they did"—he drew in a long, controlled breath—"to the rest of us. Then they stuck us in the pinnace, and let us fly off to die. But they were stuck, too, because running the ship was way beyond them. They could be gibbering on their way to Sirius by now, with no idea how to turn off the drive."

"And what would you say, Captain Grenville, if you were asked again to lead a ship with Schimmerhann chimpanzees as part of the crew?"

Grenville smiled wearily, and took plenty of time to look all around the courtroom. "Don't you think that is rather an improbable request, Counsel, given my present condition? But I'll answer you. I would say, no. I would say, definitely no. I would say, never. I would say, not under penalty of court martial, or any other penalty you care to name. I will never again permit my-

self to be in a situation in which a Schimmerhann chimpanzee is in a position to do me harm."

Deirdre Walsh moved forward to stand directly in front of him. "So based on your experience, you would say that the Schimmerhann chimpanzees are no more than animals—and murderous, unreliable animals at that?" And then, before Leon Karst could voice his objection: "I withdraw that question. Thank you, Captain Grenville. You are a true hero. No further questions, Your Honor."

"Thank you, Counsel." Judge Williams consulted his watch. "Captain Grenville, we have several more hours available today. But I know that you arrived recently on Earth, and this recollection of events must have been dreadfully taxing to you. I want to express the appreciation of this court for your testimony. And I want to ask if you need a rest, before we permit cross-examination. I must add that, because of the unusual circumstances of your appearance here, counsel for the plaintiff has the right to defer cross-examination until tomorrow."

"I would prefer to continue now," said Grenville. "If plaintiff's counsel is willing."

Every head in court turned towards Karst. He gave Sally Polk one quick glance out of the corner of his eye (*Screwed—I'm damned if I do and I'm damned if I don't*) and rose to his feet.

"Thank you, Captain. I have just a few questions. And thank you, your honor, for noting plaintiff's right to hold over some cross-examination for tomorrow."

He moved to stand in front of Gren-

ville, blocking the captain's view of Deirdre Walsh.

"Captain, I was perplexed by one point of your testimony. If I am quoting you correctly, you stated concerning the probable dead state of the Shimmies on board your ship: 'One of them certainly is.' And you mentioned this in connection with discipline problems on board. Am I to infer that a Shimmy was put to death on the ship?"

"Certainly not." Grenville's reply came without hesitation. "I put no Shimmy to death. However, I would certainly claim my right to do so to save a crew member."

"So what was the basis for your comment?"

"One of the Schimmerhann chimpanzees was on the pinnacle that reached Horus. No surviving crew member was conscious at the time, but the miners on Horus saw what had been done to us. They formed their own conclusion as to what must have happened on the ship. And they tried and executed that Schimmerhann chimpanzee, within hours of our arrival."

There was a gasp and a stirring in the courtroom, but Leon Karst was pressing on. "'Trial and execution'—you suggest, Captain, that the miners recognized the Shimmy's humanity."

"I used the wrong term. They had the Shimmy put down."

"Then let me ask another question. You lived closely with a group of Shimmies for over a year. You had a chance to observe them. Did you notice much variability in Shimmy intelligence?"

"Your honor." Deirdre Walsh moved to stand between Karst and the tribunal. "I hope that this is relevant. We have

had testimony *ad nauseam* concerning the intelligence or lack of it of the Schimmerhann chimpanzees. I don't see what can be added at this point."

Judge Williams nodded. "Your comment is noted. Captain Grenville, please answer the question."

But Grenville was hesitating. "Variability of intelligence. You mean from one Shimmy to another, Mr. Karst?"

"I mean exactly that."

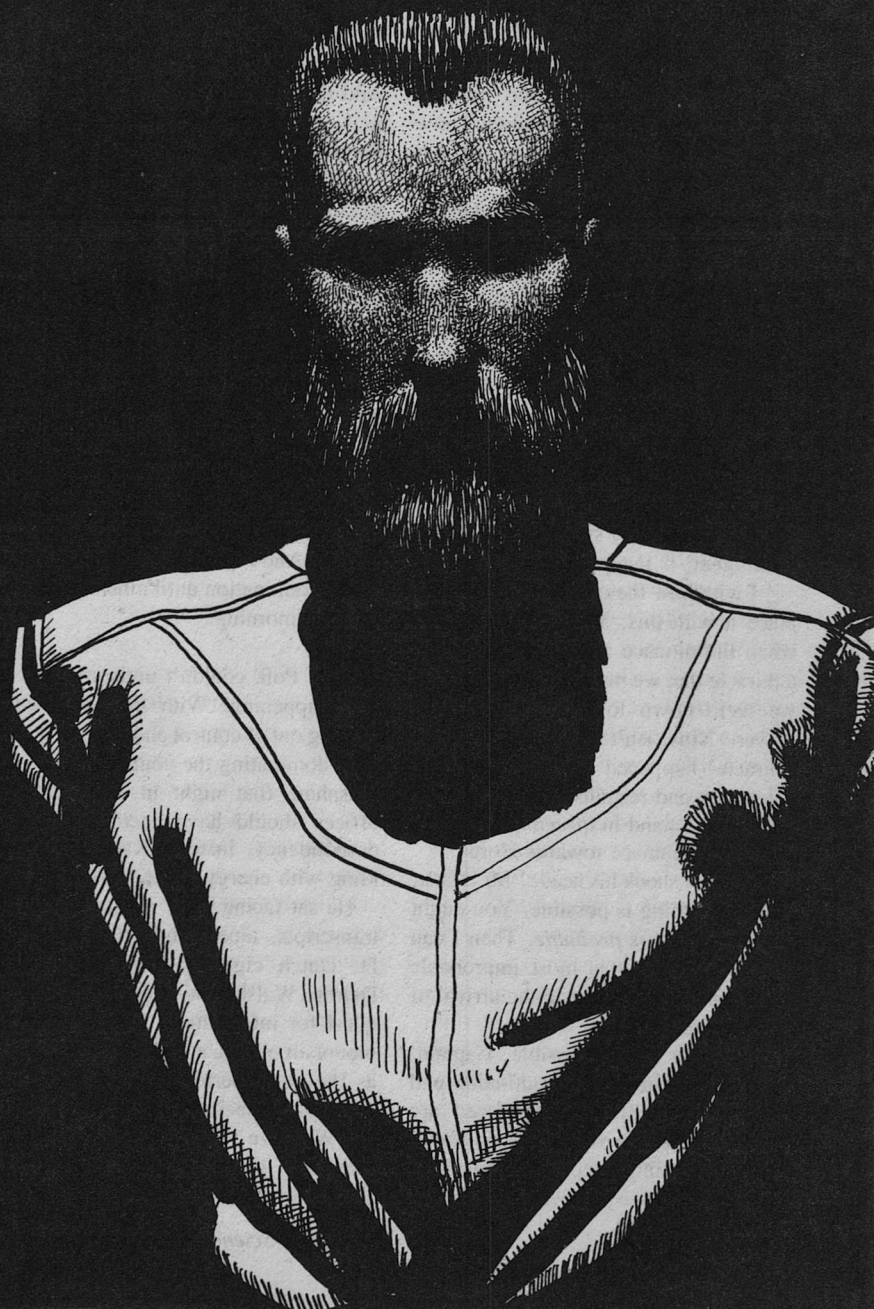
"Then, yes. Three of them—Pip, Squeak, and Wilfred, the crew called them—were very dumb. Only able to follow the simplest directives. But one of the others, Skip, he was . . . well . . ."

"He was more intelligent than the others?"

"He was supposedly much more *alert*. I would not use the word intelligent. More . . . if I say that the crew found him more understanding of instructions, I hope I will not be misinterpreted. He was certainly no more responsive, in my opinion, than any well-trained sheepdog."

"Very well. Could you tell us in a little more detail what the functions of the Shimmies were on your ship?"

"They were various. The Schimmerhann chimpanzees all helped in cleaning and general maintenance. Two of them did simple tasks in the galley. One of them was assigned to help the ship's physician. One of them assisted in the preparation of samples for mineral assay." Grenville turned to look at the members of the tribunal. "I want to make it clear that in every case the functions of the Shimmies were controlled and checked by human crew members. I insisted on it."



“Even if it was not necessary?”

“In my opinion, it was always necessary.”

“Very well. Captain Grenville, you were unconscious when the pinnacle reached Horus. Do you happen to know which of the Shimmies was on that ship?”

“I assume I do. I saw his identification band, after he’d been spaced.”

“Spaced?”

“Dumped out of an air-lock by the miners. Unless for some reason two of the Shimmies changed ID’s, the one that arrived at Horus on the pinnacle was Skip.”

“The most intelligent of the Shimmies?”

“Objection. Your honor, Captain Grenville explicitly stated that the word ‘intelligent’ is inappropriate.”

“I withdraw the question. Let me replace it with this. You mentioned that when the pinnacle reached Horus, ‘it’s a miracle that we made it at all, because we were down to our last dregs of power.’ Now, isn’t it possible that your ‘miracle’ happened because Skip, the most alert and responsive of the Shimmies, had a hand in *directing* the progress of the pinnacle towards Horus?”

Grenville shook his head. “Mr. Karst, almost anything is possible. You ought to ask me if it is *probable*. Then I can assure you that it is most improbable that Skip had any hand in the arrival of the pinnacle at Horus.”

“But it is not impossible. Captain, one final question. The mutilation and injuries that you have suffered are dreadful, truly horrifying. It is difficult to imagine beings depraved enough to inflict them. Have you ever heard it sug-

gested that Shimmies, anywhere, might be such fiends?”

“No, sir.” Grenville gave a slight shrug of his shoulders. “But I am here. And two of my crew are as badly off as I am. A fiend is only known as a fiend when he behaves like one.”

“But we do not make such an assessment without direct evidence. Thank you, Captain.” Leon Karst nodded to Grenville, turned, and faced the tribunal. “Your honor, until Friday afternoon we had no idea who the witness would be today. Captain Grenville arrived on Earth just last night. We have no records relevant to his testimony, nor information as to what records even exist. With your permission, I would like to request of the defendant that certain information be made available to me for review. And I would like to defer further cross-examination until nine o’clock tomorrow morning.”

Sally Polk couldn’t understand what was happening. With their own case drifting out of control and Russell Grenville dominating the courtroom, the atmosphere that night in Leon Karst’s offices should have been gloom and despondency. Instead, Karst was crackling with energy and enthusiasm.

He sat facing Sally across a heap of transcripts, tapes, and photographs, a fat Dutch cigar unlit in his mouth. Deirdre Walsh, anticipating Karst’s request for information, had delivered a mountain of data at five o’clock, as late as the court permitted, and now they were taking their first skim through it.

“We have to look at all this before tomorrow morning, every bit,” said Karst cheerfully. “And we’re going to

do it. But the index to what they've given us is missing at least one thing I may need. What's the signal travel time to the Horus mining colony?"

"I've no idea."

"Nor have I. Find out. If it's less than a few hours, send a message asking Horus to transmit through a video link anything they have that shows the actual trial and execution of the Shimmy. Sound and picture. We'll pay all costs. I'll notify the tribunal and the defendant that we're making the request, and we'll ask the court's permission to use what we get as evidence."

"What are you going to do with it?"

"Try to get some courtroom sympathy for the Shimmies. In the manifest they're identified only by number, but Grenville's crew helped us a lot by giving them *names*. If we're lucky, the court will witness the death of poor, helpless *Skip*, not some anonymous monkey. And the *other* thing we have to do is somehow cast doubt on Grenville's version of what happened. He's too damned charismatic."

Sally stood up. "Leon, didn't you tell me that the first rule of cross-examination is to ask questions that allow the witness only to give a yes or no answer?"

"I certainly did."

"But today you asked Captain Grenville questions that allowed him to say all sorts of things."

"Sure. Circumstances alter cases. They damn well altered *this* case. On Friday afternoon, we had it won. By noon today, we had lost."

But Leon Karst did not have the look of a man who had just lost a big case.

"So I had to go on a fishing expe-

dition," he went on. "I told you that you win cases on direct testimony, not on cross-examination. But the introduction of Grenville changed the rules—for all of us. Don't think that Deirdre is resting easy tonight. She's sweating her way through this material, as much as we are. A lot of it will have arrived with Grenville on Sunday, and she doesn't know what's in there any more than I do. It's like a game of poker. When one of the players throws in a wild card, everybody starts biting their fingernails."

As Sally went out, she realized something that ought to have been obvious long ago. Leon Karst didn't care about the *Shimmies*. All he cared about was the *case*. He would have worked just as hard for the defendant if his legal firm had been approached by them.

And yet the *Shimmies* were intelligent! Sally was absolutely convinced of it, after her meetings with them. They deserved protection and rights. So what did Leon really mean, when he said he did not want too much exposure to the *Shimmies*? That he did not want justice—*real* justice—to interfere with his fighting of the case! And Deirdre Walsh, almost certainly, was just the same. They were both obsessed with the legal battle and unconcerned with issues and ethics. Was that "true human" behavior?

Sally wondered how much she really wanted to be a partner in a leading law firm.

The change, in less than twenty-four hours, could not be missed. Yesterday the tribunal members had greeted Leon Karst and his team warmly, while re-

maining just a little cool towards Deirdre Walsh.

Today, Judge Williams was as unreadable as ever; but Laurel Garver, seated as usual on the judge's right, was avoiding even looking in Sally and Leon Karst's direction. Instead, she was smiling at Russell Grenville and Deirdre Walsh. And since the tribunal members would have dined together the previous evening, thought Sally, Garver's attitude surely reflected the tenor of those dinner discussions.

The members of the public did not try to disguise their views. Leon was hissed as he stood up to continue cross-examination. Order was restored quickly enough by Judge Williams, but the overwhelming sympathy felt for Russell Grenville showed on every face.

The captain himself looked different today, pale and tired. His head nodded forward, resting his chin on a torso that now seemed shrunken and pathetic on its cushioned support.

"Good morning, Captain."

Grenville nodded minimally at Karst's greeting, but he scarcely glanced at the smiling lawyer. Like Sally, Leon Karst had slept for less than two hours. Unlike Sally, he seemed to thrive on it. His hair was neatly combed, his white shirt pressed, his modest pearl tie clip exactly centered. He had told Sally his strategy over breakfast. Since the known facts about Grenville's mutilation were so damning to their case, it was time to take a blind leap. Karst's Rule: Conservatism is only right if you're winning.

"Captain Grenville," he began. "I would like to return to something that you told this court yesterday. One of

your crew members had developed a method of converting the Shimmy's sign language to sounds. Is that correct?"

"Quite correct."

"And those sounds can then be interpreted?"

"By someone familiar with them. Not by anyone. The sounds are in a sort of sonic shorthand."

"You were familiar with them, yourself?"

"Moderately so. Less than two of my other crew members, who are now dead."

Leon took a small recording disk from the table in front of him, and showed it to the judge. "Your Honor, I request that this be admitted to the case as Exhibit twenty-seven. It constitutes a copy of a recording disk found on the pinnacle carrying Captain Grenville and his crew members when they arrived at Horus."

Sally saw a quick look pass between Deirdre Walsh and her two assistants. Had they been able to review the disk last night with Grenville? Leon was betting that they had not, since the captain had been taken away for medical examinations.

"Captain, do you recognize this disk?"

"All the data disks on the *Poseidon* were identical in appearance. But I certainly recognize its type as one carried on the ship."

"But you have not listened to this disk yourself?"

"How can I say, without knowing its contents?"

"Captain, we are not sure ourselves of the contents of this disk. We would like to play it to you now through ear-phones. You will be able to activate the

on/off switch, simply by moving your head backwards. Would you listen, and interpret what you hear?"

"I could certainly try."

Deirdre Walsh half-rose from her seat, glanced at the judge, and subsided.

This is it, said Sally to herself. I hope I'm right, but if I'm wrong, then boy, am I wrong! It will be all over.

She had spent five hours during the night, sweating over the disk, trying to convert a strange form of oral shorthand to full meaning. She had finally been able to convince Leon—but was she convinced herself?

"I should explain to you," Leon Karst was saying, to the general audience as much as to the tribunal, "that this disk carries on it the time and date of its own recording. The time will of course be confirmed by independent sources, but I can tell you it was made three and half days *before* the arrival of the *Poseidon's* pinnace at Horus—and just three hours *after* the last routine transmission from Captain Grenville's ship."

His voice was matter-of-fact, but Sally could not take her eyes off Russell Grenville's expression. Leon was going to throw the man back into a terrible time, perhaps the very time when his mutilation had occurred. And yet Grenville looked totally stoical. A superhero. When someone had already been through so many shattering experiences in his life, maybe nothing could ever break him.

And perhaps no one could discredit him.

The earphones had been adjusted, while the witness sat there with eyes closed. The sounds he was hearing from

the disk were broadcast at low volume through the courtroom, a series of slow, harsh monosyllables. Sally had been forced to write them out, one by one, and then try to string them together to make sense. But he had had a year of practice, he would do it on the fly.

"*Chest hurt*," said Grenville after a few moments. "*Chest bad*." (So she had been right, on at least the first item! Sally's flood of relief was so intense that she almost missed the next sentence.)

Grenville's head had jerked back to stop the recording. His eyes flickered open. He turned to give Deirdre Walsh one startled look, then his head moved compulsively forward.

"*Ship die—breaking*," he said. "*Five man die, three Shimmies die. Three man sleep, three Shimmies wake. Ship dying, breaking*."

Again the bearded head jerked back. Grenville stared at Leon Karst. "Is this genuine—a recording truly found in the pinnace?" His voice was hoarse.

"According to the counsel for the defendants, it is. They gave it to us." Leon Karst nodded towards Deirdre Walsh and smiled at her. *But you didn't listen to it, did you, sweetheart? And the captain is hearing this for the first time.*

Grenville could not resist. His head was moving forward again, his eyes closing in concentration as the slurred sounds began again.

"*Little ship. Little ship fly. One man yes, two man yes, three man no. But need Shimmy. Three man sleep, three man small, two Shimmy die, one Shimmy fly. Sad, sorry. Only answer.*"

The sounds from the disk continued, but Grenville was opening his eyes.

"It goes on, but the message is repeating."

"And did you understand it, Captain?"

"I understood the words, not the meaning. It's gibberish."

"Then would you allow me to offer you an interpretation, and see if you agree with it?"

But Deirdre Walsh was on her feet. "Your Honor, do we have to waste the time of this court on a stream of what is rightly described as gibberish? Captain Grenville has said he does not understand it, and he is the expert. What purpose is served by listening to the plaintiff's imaginings?"

"Mr. Karst?" Judge Williams was staring at Leon with eyebrows raised.

"A most important purpose, Your Honor. If you will permit me five minutes, no more, I believe we will be able to cast a new light on Captain Grenville's arrival at Horus."

"Then proceed." The judge held up his open hand. "Five minutes."

"Thank you, Your Honor. Captain Grenville, let me ask you one preliminary question. The single most basic fact taught to any Shimmy is that the life of a normal human is sacred—far more so than the Shimmy's own life. Have you heard that?"

"Many times. But that does not make it true."

"We shall see. Let me propose a sequence of events aboard your ship. You were on the way to Horus when some major catastrophe took place. Perhaps it was an internal ship malfunction, perhaps it was an impact with some other body. You were knocked unconscious. Is that possible?"

Grenville gave a dismissive shrug. "If I was unconscious, you can suppose anything."

"You and two other crew members, in the fore part of the ship, were rendered senseless. The rest of the crew were killed outright. Three of the Shimmies were killed also, while the other three—including Skip—were unharmed. But the ship was disintegrating, losing air. '*Chest hurt*,' as one Shimmy told us, '*Ship die—breaking. Five man die, three Shimmies die. Three man sleep, three Shimmies wake. Ship dying, breaking.*' That is a clear statement of the situation. It was left to the three Shimmies—intelligent or not, we won't argue that point now—to save themselves and the three unconscious humans.

"Skip and the others must have tried, but unfortunately it couldn't be done. The ship was doomed, and although the pinnacle was intact—'*Little ship, little ship fly*,' as Skip told us—it didn't have enough fuel and power. Not for three men and three Shimmies. It could just carry the mass of two men and no Shimmies, or one man and one Shimmy, and squeak through to Horus. But no more. The Shimmies could have stuffed two humans into the pinnacle and stayed behind themselves, but that wouldn't solve anything, because the men were all unconscious and they couldn't fly it. Again, Skip told us the whole thing: '*One man yes, two man yes, three man no. But need Shimmy. Three man sleep, three man small, two Shimmy die, one Shimmy fly. Sad, sorry. Only answer.*'

"In other words, the pinnacle could carry *one* Shimmy, to fly it, with three men—but *three men small*—three un-

conscious men whose mass had been surgically reduced as far as possible, to the approximate total mass of *one* man. 'Sad, sorry. Only answer,' said Skip. Not a nice answer, but to the three Shimmies, the *only* answer. They could not bear the thought of killing a human, of allowing a human to die who might somehow be saved. So they performed that awful surgery, on Captain Grenville and the other two crew members. Then two Shimmies stayed behind, to die on the ship. The other Shimmy—Skip, the most able of them all—piloted the pinnace, and just made it to Horus with, to quote the Captain, the 'last dregs of power.' The three human passengers survived."

Leon Karst allowed his eyes to roam slowly over the hushed but restive courtroom. "That, my friends, is the true story behind the loss of the ship, the mutilation of the crew, and Captain Grenville's improbable survival. The Shimmies were not murderers. They were saviors, who gave their own lives so that three humans—"

"Objection." Deirdre Walsh was on her feet, speaking in a suddenly turbulent court. "Your Honor, this has gone on far too long. This is not evidence. We do not know how those messages originated, or who created them. We have been listening to something that is less than hearsay! It is pure fabrication. I ask that the last speech from the plaintiff's counsel be removed from the record."

Judge Williams acknowledged her with a nod, but his attention was on Grenville. "Captain." He spoke through the noise, not trying to silence it. "If your ship suffered an accident, as Mr.

Karst has suggested, what is the chance that it will ever be recovered?"

"Out near the Egyptian Cluster? Very small. Negligible."

"Do you accept the counsel for the plaintiff's reconstruction of events?"

"I—think not." After Karst's analysis, Russell Grenville had become hesitant. His eyes were blinking rapidly. "There—there could be many other scenarios that fit such a message."

Grenville's sober manner carried great moral authority. The judge nodded. "Mr. Karst, based on the captain's comments I am forced to concur with the defendant's counsel. Ingenious as your speculations—"

"Your Honor." Leon Karst was breaking one of the first rules of legal practice; never interrupt a judge. "Before you make that decision, I beg you to consider one more item of evidence. It will take only a moment."

"Has it been introduced as an exhibit in this case?"

"Not yet. It could not be. It arrived only early this morning from Horus. We have had no time to make it available to the defendant, though of course they will receive a copy."

"Describe its nature."

"It is a recording made by one of the miners, of the execution of Skip—"

"Objection!"

"—of the death of the Shimmy, Skip, on Horus."

Judge Williams glanced to the other two tribunal members, but it was a formality. His own curiosity had been roused. "If it is brief, you may proceed."

"If we could reduce the lighting level . . ." Leon Karst nodded to Sally,

who had the recorder ready to run a projection onto the courtroom wall.

She switched on with a shiver. Leon was risking everything on the next sixty seconds, winnowed by Sally out of an hour of recording received from Horus. She had warned him that she found the modified sign language used on Grenville's ship unintelligible, but Leon must feel that this was his last chance to save the case.

The picture had been recorded by an amateur and transmitted over a low-bandwidth channel. Grainy and noisy, it showed a surging group of men in miners' close-fitting black suits. They were floating in the low-gravity enclosure of an outside asteroid chamber. Their faces were angry and pitiless. In their midst hung a Shimmy, his brown fur marked by cuts and patches of blood, and one of his legs bent at a strange angle. They were treating him roughly, forcing him towards an airlock.

"Murdering monkey," said a loud voice from the group. "Get in there, and go straight to hell."

"Captain Grenville." Leon Karst spoke over the noise of the recording and the rising tumult in the courtroom. "Did any of the miners on Horus understand Shimmy sign language?"

"I doubt it. Why should they?" Grenville spoke quietly, nervously.

"Then can you tell us what Skip is saying?"

For the Shimmy, battered and bleeding, was gesturing frantically at the men

as he was dragged and pushed closer to the lock entrance. They were taking no notice of his frenzied signals, interrupting them with blows and slaps.

"I think I can," said Grenville. "If I can just get a good look . . . Uh. I think . . . *Not—kill. Never—kill—man. Save—man. Save man. Skip save man.*"

Then the Shimmy was being handled so roughly that he could make no more gestures. He was flung violently into the lock by a dozen miners, bounced off the outer metal wall, and hung alone covering his head with his hands. After a few seconds he turned to face his executioners. In the bare, functional chamber, with vacuum only a few moments away, his expression changed. It became calm and resigned, almost peaceful. And as the door slid closed he made another set of gestures, over and over.

"Captain Grenville?" said Leon Karst. The captain was staring at the screen, white-faced and silent. "Sir? Can you read them?"

But Grenville had lowered his head. Tears were trickling down his cheeks, and he seemed to be speaking only to himself.

The courtroom froze. And as the whispered words reached her, Sally knew that the case was over.

"*Skip—forgive you,*" Russell Grenville was saying. "*You not know—what you do. Skip forgive. Skip forgive. Skip forgive.*" He looked up, beyond the tribunal and beyond the courtroom. "Great God in Heaven. Skip, can you forgive us all?" ■

THE MUSKETEER MENACE

Laurence M. Janifer

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I think the only reason I didn't kill the idiot was that he came at me very loudly. I was walking casually along, minding a variety of interesting businesses—dancing girls, spheres of chance, fire-jugglers and the like—when somebody started whooping away off to my left somewhere. The whooping was loud enough to carry over the sounds of four or five enthusiastic brass bands, and it gradually, over a couple of seconds, turned into understandable words. If "understandable" is the term I'm groping for, of course, because the words were: "At last, miserable dog! You will die for your crimes against the people!"

This puzzled me and I turned to see who the miserable dog was. I saw a pudgy little man in a sky-blue coverall running toward me. He was brandishing a gleaming sword about three feet long.

Around me, people of all sorts were shrieking and scattering. The sword-pudge wasn't running very fast, but he was covering ground as well as he could, wheezing a bit but ripping out heroic-sounding phrases as he came—"Now fear strikes your heart, cowardly Duke!" for instance—and the effort of trying to talk and jog at the same time helped slow him down.

I heaved a medium-sized sigh, reached for my beamer and made sure, by touch, that it was set for nothing worse than stun. Then I pointed it at Pudge and shot him down.

He dropped the sword, which clattered in the very sudden silence, and fell within an inch of it. I put the beamer away and heard more footsteps coming toward me, and just as one of the brass bands started up again I heard a sound

which is not generally a very comforting one: a police whistle.

On the worlds which have them—and it always comes as a surprise to them that some worlds don't—police officers are likelier to be a nuisance than a help, at least if your name is Gerald Knave. They not only do the same sort of rescue work I am occasionally caught doing, but they do it for a weekly or monthly stipend, which lowers the rates I would like to collect all to hell. But that particular whistle was welcome; it told me I was going to have somebody to explain Pudge to, and just possibly somebody who could explain Pudge to me.

No such luck. When he caught up with the action he turned out to be a man in the usual yellow uniform, with the usual expression of fiercely restrained superiority, and the first thing he said to me was: "What's going on here, fella?"

I told him I'd been hoping he had the answer to that, and he looked about eight degrees fiercer.

"No funny stuff, now," he said. "This man's unconscious, and I saw you put away the beamer."

"I wasn't hiding it," I said. "Whoever he is, he came at me with that sword. The one he's lying next to."

The police officer accomplished the interesting feat of glancing at the sword without taking an eye off me. His right hand rested within a quarter-inch of the butt of what was certainly another beamer, just possibly one rated almost equal to mine. "Now why would he do that?" he said.

I gave him a shrug and a pair of lifted eyebrows. "I am damned if I know."

He asked for my name and for some

identification, and I managed to get it out to show him without setting off any alarms, so to speak. He asked for the beamer and I handed it over without a murmur, keeping my other hand unobtrusively within its own quarter-inch of the butt of my slug gun, whose existence was not obvious.

The police officer looked over the beamer for some time, and spent even more time on my identification. I kept about an eye and a quarter on Pudge, wondering when he was going to come to and what he would try doing when he did, but he was still face down when the officer handed my beamer back and said the first thing that really surprised me.

“Sixth one today, damn it.”

I said: “Sixth what?” and he sighed again, bent down to put wristcuffs on Pudge, and said, slowly getting to his feet again: “We’ll walk this one to the guard station when he wakes up. I’ll explain while we go.” Which was as polite an invitation to the station as I could remember getting; “police” and “polite” are derived from the same word, but the fact is of interest, as a rule, only to professors of linguistics.

As it turned out, it wasn’t much of an explanation, anyhow.

I ought to explain about the Paris Fair, which is where all this happened.

Paris is a small world not too far from Sol, orbiting around a sun the inhabitants call King Louis. The planet had been settled for two hundred years, more or less—the actual date, as usual, is the subject of several hundred historiographical arguments—and the inhabitants, almost all of them human, had

decided on a gigantic fair. They had spared no expense: they’d built a city for it to take place in, together with a lot of replicas of what they thought the original Paris (a city named after one of the legendary heroes of ancient Greece or somewhere of that sort, which had apparently celebrated the heroic Paris’s connection with apples by making and drinking the hell of a lot of very interesting drinkables called Calvados) had been like. They’d even put up three identical versions of a thing called the Apple Tower, which is the most useless-looking construction I recall seeing, like the skeleton of an enormous gantry crane without the crane. For all anybody knows, Paris might have been a rocketry center, and the crane got shot off somewhere during the Clean Slate War.

Having nothing much to do that month, I had decided to take in the Fair. Advance word had it that there were any number of interesting sights to lavish money on, and a great deal of Calvados as reconstructed from preSpace recipes, more or less. And for three or four days my round had been a round of fun and frolic. I’d met a few women whose potentials struck me as attractive, lost a surprising amount on games of chance and won about a sixth of it back on games of skill, thought about seeing a historical attraction—a new and refurbished version of something the ancients called a Film, or a Mover—and generally played tourist, as they say. (I wasn’t actually playing Tourist, I was playing Traveler. The difference is that a Tourist is somebody who thinks his rules apply where you live.)

On the afternoon of the fourth day

here came Pudge. Not really a contribution to fun and frolic.

While waiting for him to revive, I took a real look at that sword—there hadn't been time when I beamed him. I wasn't really surprised to find out that it was a sword only by courtesy of Paris Tourism; it was a gleaming, entirely fake jobbie that was a duplicate of sixty thousand others, selling as souvenirs all over the damned city. If he'd stabbed me with it he might have broken the skin, and he would almost certainly have bent the sword.

What this made him was a garden-variety maniac, but what took him right out of the garden was the fact that there had been five others like him that day.

The police officer was looking sadly at Pudge. I tapped him and said: "How many altogether?"

"How many what?"

"Whatever this one is the sixth of," I said.

"Crazy people with swords," he said, classifying Pudge neatly. "Since last week—the first we heard of it was about ten days ago—thirty. No, thirty-one, now."

Paris has a twenty-two hour day, which made the crowd of sword-carrying maniacs (or souvenir-carrying maniacs) seem even more numerous when I translated into Comity Standard. "Something in the water?" I said.

"For all we know," he said, watching Pudge begin to stir and groan, the way they do when they come out of a stun, "something in the Calvados."

"You can discount that," I said, "or I'd be waving a souvenir myself."

"Well, you had a beamer," he said sadly.

At the guard station, maybe five hundred meters down one of the curving roads that had been copied, more or less, from the original city—this one was called the Street of Peace, which sheer noise had put in doubt even before Pudge had come along—Pudge was booked for a short bit of incarceration, and I was released with a warning. Pudge didn't seem to have any idea what he'd done or why he'd done it, though he did remember buying a souvenir sword, sometime mid-morning, about eight hours before.

I was about to walk away—I had an appointment with a lovely I really didn't want to miss—when a total stranger rushed into the room, took a look at me and said: "Good. I need you."

This one was dressed in a black form-fit, just as I was. He had light-brown hair that stuck out all over his head, and an expression that was somehow both sharp and bemused. He looked as if he weighed eighty to ninety pounds, or would have if he'd had lead weights in his pockets, and he was five or six years older than I, and about a foot and a half shorter.

Brightly, sidestepping his rush, I said: "Me?" The police in the station were looking interested. My hand edged over to my beamer.

"You," he said. "Gerald Knave. As a consultant."

"I don't consult," I said, which is sometimes true.

"For a fee," he said. He named a sum. I pushed on past him. He doubled the sum.

I stopped at the exit. "Consult about what?" I said.

“Stabbing people,” he said pleasantly, looking perfectly sane. “We need to know what it feels like.”

I will never know why I didn't just show him a pleasant smile and run like hell. His last mention of money had something to do with it, but I wasn't entirely certain that he was talking about real cash. Sanity did not seem to be in great supply, and he might have been talking about the Souvenir Francs that were being sold alongside the swords.

But I let him lead me out of the station, and down the Street of Peace a little way, and we turned off onto some other Street of Something or Other and finally came to a large stone pile with a sign over its entrance: HOTEL DE VILE.

It seemed an odd place for anybody to stay (I was located in one of the hundreds of pensions around the city, a pension being until that week something that, unhappily, prevented over-aged bureaucrats from the starvation they deserved), but Frak Webble was pleased with it, and I will say that his suite was not at all Vile. Rather pleasant, in fact.

There were several other people in the suite, and all of them seemed very pleased to see me, once Frak—he'd introduced himself along the way—had explained who I was: “Gerald Knave. The Survivor.”

“Not the only Survivor,” I said.

“A well-known one, and the only one we know of here in Paris,” Frak said. “And you'd know about stabbing people.”

I thought back. “I've never actually

stabbed a person,” I said. “It's not the sort of thing that's necessary, not yet.”

“Naturally,” he said. “Beamers—slug guns, perhaps—bombs, poison, we have so many methods available, these days.”

“Actually,” I said, as mildly as I could manage, “I've killed comparatively few people. A Survivor isn't in the killing business; if possible he's in the keeping-alive business. Live people, and live aliens, can provide information. Dead ones give you depressingly little, and you usually have to perform autopsies to get even that.”

Frak laughed as if I had told a very funny story. When he did, all the others joined in. It began to occur to me that Hotel de Vile was a fairly good name for an insane asylum, if you thought of it that way.

“Ah,” he said at last. “But you have stabbed animals? Living animals?”

A Survivor checks out as an expert on every weapon known to man, and on sixty or seventy things not normally classified as weapons—because when you do have to kill something, or somebody (human or alien), circumstances may not wait patiently while you cast around for your weapon of choice, or even for a weapon. You may have to use a handkerchief, a piece of wire or an end table.

I told the assemblage that, more or less. They all nodded, and turned to Frak, who thought for a minute and then said: “Including a sword?”

“Including a sword,” I said, remembering some events on new planets.

“You see,” he told me, “we've been stabbing beefsteaks, and cushions, and

all sorts of things, and I'm not sure we have it right."

I told him that if the beefsteaks and the cushions died, he was doing it right, and he stared at me as if I were the inhabitant of a Home for the Irregular. And after a while, a few drinks of Calvados (it will never replace civilized liquors, but it does make a nice Official Potable for a Fair), and some more chatting, things began to make a certain small amount of sense.

Frak, it turned out, was the Producer of the particular Mover that was featured in Paris during the Fair—the Prime Mover, as it were. And the Mover (he kept calling it a Film, which is what I'll call it from here on to avoid confusion—God knows there was enough confusion around already) involved stabbing people.

More, the thing was full-sensory. A new departure in Film, everybody told me. It was a story of preSpace Paris, taken from an author named Dune (which I'd always thought was the name of a preSpace novel): Alexander Dune.

It dealt with Musketeers, who were apparently people who went around stabbing other people at a perfectly fantastic rate. The hero was a particular Musketeer named Dart Again, which seems the hell of an odd name even for a homicidal maniac, and he had three friends—Artist, Portly, and somebody called Error Miss—who cleaved to his side and were also very big on stabbing people. When the thing was explained to me as a historical picture of preSpace Paris, it struck me as unlikely that any of the inhabitants of that city had lived to maturity.

The Musketeers, in short, acted very much like Pudge the Maniac, whatever his name had been (I may have heard it back at the guard station, but if so it had passed right out of my mind. Given his lack of talent for the role, I think of him now as Error Miss).

But I wasn't at all clear on how a Film could have driven a small army of people entirely out of their minds. Pudge, for instance, though he'd mentioned the souvenir sword—which began to make a lot more sense to me, if preSpace Paris had been as homicidal as Frak and company were making it look—hadn't mentioned seeing the Musketeer Film.

He hadn't not mentioned it, either, so to speak—and he might have seen it in the eight hours or so between buying the sword and trying, however badly, to use it.

And, of course, there was another question: Why me, O Lord? Why me?

I filed all that—it made a crowded sort of file—while Frak went on explaining the Film.

"So we have to have a tactile sensation that's absolutely on the nose," he said.

"Right," I said, heroically refraining from five or six puns that occurred to me. "What do you want me to do, describe it for you?"

"Not at all," he said blithely. "I want you to experience it."

Happily, he did not want me to experience being stabbed; money has its charms, but not being stabbed is even more charming.

Nor did he want me to stab anybody else, not even Pudge. Or Error Miss.

Instead, he wanted me to experience his damned Film.

I held off. The thing was three and a half hours long, which was going to make me even later for my lovely appointment than I was already going to be. At last Frak agreed to clip out just a stabbing sequence, about sixty seconds long.

I sat down in one of his prepared theater seats—the place had been cleared out for my special showing—took a deep breath, and shut my eyes. That meant I wouldn't get visual sensations—visual input came from a screen hung above eye level so people in back rows could see it without having to worry about the hats or heights of people in front rows, just the way it did in preSpace theaters. Aural input came from a surround of speakers, much like preSpace arrangements there, too, as far as anybody could figure them out.

The rest of the senses—taste, smell, touch and proprioception—came from the field net, a carefully beamed complex of wave inputs picked up by the theater seat and rebeamed into a “wrap-around” for the customer, whose own electromagnetic field—everybody has one, though people used to call it an aura and imagine it came in pulsing colors—adjusted to take it in as sensory information. That's as far as it can be explained, I'm told, without being unfair and resorting to mathematics, which few enough people speak.

All I needed was touch and proprioception, so I concentrated on those. There was a faint carrier-wave hum, and a brief burst of music that I recalled vaguely, from some historical 3D show or other, as the Mayonnaise, and I felt

the grip of a basket-handled sword in my hand, about five feet long from the feel of it, and nicely balanced.

Then I felt my arm go forward and stab a beefsteak.

My expression must have changed. I heard Frak's voice say: “Replay,” and I felt myself stab the same beefsteak again.

Frak said: “Replay,” once more, but I got up from the theater seat before I did mortal damage to the beefsteak all over again; it's not a sensation that grows on you, exactly.

Lights came up and I was standing in his theater, surrounded by anxious-looking people. “Well?” Frak said.

“I gather the sensation is supposed to be one of stabbing somebody during a fight?”

“Exactly,” he said.

“Well, it isn't,” I said. “A beefsteak just lies there. It's solid all the way through. And that makes a difference. You've got to have a shock when he comes at you—when the swordpoint touches him. Then a second shock, almost immediate, as your sword goes through skin, because skin is tough. And after that you get a sort of uncontrollable—well, nearly uncontrollable—slide until and unless you hit bone. Once the sword is through, there isn't nearly as much resistance. People aren't quite solid all the way through; the skin's the tough part.”

I can't tell you how uncomfortable it made me to stand there and relive enough of stabbing, even animals, to say all that. It was accurate, because accuracy was what he was paying me for, and it was just a little sickening,

because, as I've said, I am not in the stabbing business.

Frak was nodding and going "hmm," for a minute or so. "A shock and a shock and a slide," he said, making it sound like a new dance step.

I said: "Right," because it was close enough.

"Wonderful," he said, which is not the word I would have used. He consulted with the others, tossing terms like "frequency partial bias" around as if they were jugglers' tools, and after a patient while he tossed some money at me with the same light-hearted abandon. I grabbed it, said a few polite farewells, and got the hell out of the theater while they were still talking.

Luckily, I made it to the pension of my appointment (the pen of the hotel of my gardener?) while the appointment, though understandably irritated, was still pacing up and down and muttering through her lovely lips.

I was not interrupted by trick swordsmen of any kind.

I did, of course, spend part of our time spinning out the whole story for her, and she was most appreciative, which is the best return on these stories I can think of, and while money may not buy my happiness it purchased a fair ration of hers for a time, thanks to Frak Webble and his new departure in Film.

And much later that night—a twenty-two hour day makes the nights altogether too short—it happened that my appointment was murmuring hypnotically in my ear. The subject of the murmur doesn't matter for this report, though it interested me greatly at the time, but the murmur does.

I sat straight up in bed, disarranging a great deal, and said: "Good God."

My appointment gazed at me with limpid blue eyes. "I said something wrong?"

"Not at all," I said. "Au contraire, and other Parisian phrases."

"Well, then—" and she settled a bit closer to me.

"Hypnotically," I said. "You murmured at me hypnotically."

She blinked. "I didn't mean to—"

"The hell you didn't," I said, "and that doesn't matter. It's the swords that matter."

"Knave," she said, drawing back a bit, "have you gone crazy?"

It had been a big day for maniacs, but, as I hurriedly explained to her, that was not my trouble.

Au contraire, as the Parisians say.

Six minutes later I was out on the street looking for transportation. Luckily, the Fair had resurrected a whole lot of preSpace ground car notions, and something called a taximeter-cabriolet (you'd think the ancients would have had a shorter word) pulled up and swallowed me. I poked my head out the window and told my appointment to wait for me in the room—for fear of roving maniacs with souvenirs—and, when I'd seen her head back to the pension with a puzzled air, told the t-c driver to take me to the guard station.

Halfway there I rethought things a bit and redirected him to the Vile.

And six or seven minutes after that I was looking at a rumpled and sleepy Frak Webble, dressed in an authentic-preSpace-looking nightgown—grey and brown, and absolutely hideous—and

telling him that his new departure was going to have to depart.

He said: "You must be crazy."

I took another look at the hideous nightgown, remembered his daytime clothing, and asked him: "Have you been attacked by one of those maniacs?"

"Three days ago," he said. "A little old lady with a souvenir sword. I tripped her."

Which put the last piece of the puzzle in place.

There were maniacs around for some time thereafter, but they thinned out fairly rapidly—it seemed that a simple stun knocked them back into sanity, though with a memory loss for the period of mania. Which is very lucky, all things considered.

You see, there's an easy way to hypnotize any good subject: make him stare at a lighted object in a dark room, and have the object above his eye level.

In other words, have him stare at a Film screen.

A lot of the popularity of preSpace Film seems to have been due to that hypnotic effect—it's why many Films don't seem to have had the same success on the ancient flat 3V screens, for instance. But the hypnotism was never really complete—though aural input was added once the ancients figured out how to hook sound in with the Film, and though smell was experimented with in a variety of primitive ways, nobody developed a full-sensory Film.

Until Frak Webble.

And that did the job. A given percentage of customers—the very good hypnotic subjects—walked out of his sorcery with swords convinced they were Dart Again, and a very high percentage of those went out and bought souvenir swords immediately thereafter, or were carrying souvenirs (as Pudge, or Error Miss, must have been) when they went in.

Being Dart Again, such a customer would swing out down the Parisian Street of Whatever it Happened to Be searching for villainous types to stab.

And villainous types were easy to find.

Like me, and like Frak Webble, they wore black.

Nobody knows how long that particular hypnotic illusion might last, though the Film is now visual-aural only—or whether some of the maniacs visited the Fair and got off-planet without showing their mania. Which is why I'm sending out this report.

If you are menaced by a character spouting Heroic speeches and waving a souvenir sword—don't worry. Take the sword away from him (it won't cut paper) and hit him over the head with the hilt, the only part solid enough to stun him. Then hunt up a beamer and give him a jolt.

He'll come out of it in fine shape, though a little puzzled. And you can walk away, carrying the brave sword.

And humming the Mayonnaise. ■

The Alternate View

CAP THE VOLCANOES!

G. Harry Stine

The depletion of the stratospheric ozone layer in the Earth's atmosphere is, we are told, catastrophic. A growing hole in the ozone layer has appeared over Antarctica, we are told. This depletion of the ozone layer by mankind's rapacious assault on air conditioned comfort through the use of fluorinated hydrocarbons (FHC) will cause skin cancer and even worse. In short, the world is coming to an end (again).

I must say one thing for the doom-sayers and down-siders: They are certainly persistent. Furthermore, they have caught on to the fact that we are over-communicated, as Hugh Downs once pointed out; we are constantly bombarded by so much data that we tend to forget quickly because so much new data is coming in.

We had pretty much put all of this behind us in the 1976-1980 time period—which pre-dates the Reagan era and therefore is not a consequence of it. Or so I thought.

What triggered this Alternate View was an article in the British science magazine, *Nature*, by Rose and Robert Symonds of Michigan Technological University with Mark Reed at the Uni-

versity of Oregon. They report that the Earth's volcanoes are belching 1.4 million tons of ozone-destroying gases into the stratosphere annually.

On the basis of this finding, it is obvious that we must immediately set out to cap all the volcanoes on Earth to prevent them from further destroying the ozone layer. Environmentalists, arise to this new threat! Well, you arose to all the rest, didn't you? Why not this one?

Back in 1983, when I wrote a book entitled *The Hopeful Future*—which didn't sell very well because no one is really interested in any book about the future that isn't sensationalistic and doesn't scare the living hell out of you—I spent one chapter discussing what I termed "the impossible futures." One of these was the "destruction of the ozone layer." But, just in case I might have missed something, I went back now and rechecked everything.

Apparently many people who are bemoaning the destruction of the ozone layer never took chemistry or, if they did, threw away their text books and forgot what someone had tried to teach them. I didn't throw away my chemistry texts; I still have all six of them plus the "Chemical Rubber Handbook."

Two ozone molecules are created from three oxygen molecules plus energy. Ozone is created naturally from atmospheric oxygen by the action of the ultra-violet component of sunlight.

Changes in the Sun, and other natural factors, cause the atmospheric ozone layer to vary by plus or minus 10%.

The natural ozone layer isn't very thick—only a fraction of a millimeter at STP.

The "ozone hole" was discovered

over the antarctic regions. Has there been a similar "hole" measured over the arctic? If not, why not? Certainly far more fluorinated hydrocarbons have been released into the atmosphere over the northern hemisphere. What is the transport mechanism that would concentrate all these fluorinated hydrocarbons over the south polar regions?

Certainly, ultraviolet radiation causes skin cancer among the minority population of Earth that does not possess a natural defense against it in the form of an increased amount of melanine in the skin. In short, only white folks are at risk. (If you want to make a racial issue of this, be my guest, because you can back it up with data! I'm not making a racial issue of it by bringing it to your attention.)

But I don't wish to concentrate on the ozone issue to the exclusion of others. How about carbon monoxide?

Again, human activities add about 270 million tons of CO to the atmosphere annually. Most comes from the combustion of fossil fuels. In dry air, CO can persist as long as three years. But winds will certainly take it into humid air where it lasts for minutes. CO is metabolized by such organisms as the fungi of the *Aspergillus*, which live in soils everywhere and thus use all of this 270 million tons, and more, to enrich the soils of forests and fields. Thus, in spite of our activities, CO will never build up to dangerous levels on a world-wide basis. In cities, it's something else. The average urban CO concentration is about 1.5 parts-per-million (ppm). In Los Angeles, on a smoggy day, it can reach 35 ppm. In parking garages and vehicular tunnels, it's sometimes 50 ppm. Many

people voluntarily subject themselves to CO levels as high as 42,000 ppm while smoking a cigarette. Thus if a smoker spends several hours in highly polluted city-air, the CO content of his/her blood will actually decrease.

A lot of CO, we are told, comes from automobiles. Monitoring stations on land and sea have been measuring CO levels for many years. Since the ratio of automobiles in the northern and southern hemispheres is roughly 9:1, you'd expect the northern hemisphere to have a higher CO concentration. However, no difference exists, and a higher concentration of CO has been measured over the oceans than over the land areas of Earth. This is an interesting piece of information, too, because 93% of the atmospheric CO comes from plant life; only 7% comes from man-made sources.

We're small-time when it comes to air pollution. The late Dr. William Percora calculated that all of the human-generated air pollution during the last several hundred centuries does not equal the amount of particulates and noxious gases spewed forth from just three volcanic eruptions: Krakatoa in 1883, Mt. Katmai in 1912, and Hekla in 1947. A few years ago I calculated that if we burned all the known resources of fossil fuels and all the biomass on the planet within one year, we might be able to raise the temperature of the planet by 0.4° Fahrenheit, provided none of the heat of combustion was radiated into space. . . .

Here's another one: The "greenhouse effect," about which I had something to say in an earlier column. Now, however, according to a single point datum

revealed by a single witness before a single congressional committee and based upon a one-dimensional mathematical model of the Earth's atmosphere, we are indeed suffering from an increasing greenhouse effect. (I've testified before Congress three times concerning the need for a proper national space policy and a properly supported long-term space program, testimonies backed up by numbers at least as firm; no one listened to a whole group of us, so why did they listen to this one lone person whom I'd never heard of before? How did he do it? How did he arrange to testify in Washington in the middle of a heat wave?) However, I cannot find that this is supported anywhere by any long-term climatic data. The data clearly shows that the world is now in a cooling period following a heating phase that lasted from the middle of the 19th century until the 1960s.

How about our destruction of animal species on this planet?

Yes, human beings in America have managed to wipe out the passenger pigeon, an incredible feat when you think about it. Many people feel that human beings are responsible for the disappearance of some other animal species. While we may have hastened the disappearance of some, abundant evidence suggests mankind has had little impact. Biologists point out that 50 species can be expected to disappear in the 20th century but also remind us that about 50 species became extinct in the 19th century, and 50 species in each of the centuries before that. Dr. T. H. Jukes at the University of California has pointed out that about 100 million animal species have become extinct since

life began on Earth about 3 billion years ago. Thus, animals come and animals go as a natural consequence of something Mr. Darwin discovered. The human race is a recent newcomer to the scene, so we've had nothing whatsoever to do with the disappearance of millions of species.

In fact, when it comes right down to it, we're a miserable failure at genocide. In spite of an all-out centuries-old war on rats and other rodents, we haven't made a dent in their numbers, much less eradicated a single species. And in spite of all our high technology we haven't been successful in eliminating a single undesirable insect species!

It doesn't get any better when it comes to bacteria, either. They say that smallpox has been eliminated. I am not willing to bet my life against the possibility that somewhere in deepest, darkest, dankest Africa exists a small village of smallpox carriers.

A friend of mine owns most of the Douglas DC-7 aircrafts left in the world. They make excellent spray planes because they can carry a lot of insecticide and fly for a very long time over great distances. Last year, his company sprayed most of the western Sahara and the Sahel regions of Africa to hold down the locusts and grasshoppers. This year, the environmentalists put pressure on the UN to stop it because dieldrin and malathion might cause an increase in the cancer risk of people in the western Sahara and the Sahel. As a result, the hoppers and locusts are back by the zillions and the crops are failing. But the people of West Africa certainly aren't going to worry about dying of cancer; they are dying of starvation instead.

I've come to the conclusion that the people who are trying to save the world are probably quite sincere about it but they don't know much about science and certainly nothing about systems engineering.

However, I've finally found a cause that I can support. Here in Phoenix, they repave the streets by laying down a sticky layer of asphalt then spreading granite chips immediately upon the fresh asphalt. Regular auto traffic is then depended upon to roll the chips into the sealant. The process is called "chip seal." It's a mess while it's being done, and no one really likes it with the exception of the auto glass companies who

work overtime replacing windshields. A new "popular" movement has erupted, complete with T-shirts, bumper stickers, the whole nine yards, led by a small silk-screening company who saw an opportunity to use humor in the Greek manner to maintain perspective as well as to make a few bucks like all the other world-saver causes. We are now entreated to "Save the Chip Seal!"

Makes about as much sense as capping volcanoes.

And a lot of the other "save" causes that are currently and repeatedly raising the anxiety level.

I have bad news for the environmental pessimists: We're going to live after all.



● If you can write a nation's stories, you needn't worry about who makes its laws. Today, television tells most of the stories to most of the people most of the time.

George Gerbner

● Remember that the most important thing is not your surroundings, but the intelligence with which you use those surroundings.

French

submitted by G. Harry Stine

THE SYLPH

Rick Shelley

Every individual is, to some extent, a product of his or her own culture. And when the products of two very different cultures are thrown together . . .

Nicholas Jainschigg





There was no gray period, no semi-conscious dreamland. The dividing line between unconscious and conscious was as sharp as if someone had flipped a switch. I realized at once that I was in a hospital. The memory of being wounded was strong. I had been in the middle of a battle, on the wrong end of a massacre. Raging pain had been quickly followed by a void. But there was no pain when I woke. I lay on clean sheets and mentally inventoried my body. When I discovered that my hands and arms worked, I made the inventory manual. Everything was still there. I didn't notice any dressings, but I felt new scars in several places, so I knew I had been unconscious for a good while.

The hospital was on a planet, not aboard ship, so it was almost certainly the enemy's hospital. That made me a prisoner of war, too. There was no way our troops could have reversed the flow of battle. That had become a waterfall. We were being chopped to pieces when I was hit. My battalion was trying to hold a shrinking defensive perimeter so at least part of the regiment could evacuate.

It was daylight when I woke. There was a window behind me and off to the side. All I could see from bed was light and sky. Sitting up was an adventure. I got light-headed, weak, the first time and had to lie back quickly. I was alone in a small room—bed and bedside cabinet, no bars on the window. I wanted to try sitting up again, but it had to wait. I slept.

"How are you feeling?" I didn't hear the nurse enter. I was staring at the ceil-

ing, daydreaming. I turned my head. She appeared to be in her early twenties, petite, attractive. Her name tag said Willa McD.

"OK, I guess." My voice cracked.

"I'll get you some water." I tried to sit up again while she poured. Willa stopped me and adjusted the bed to set me up halfway. Better.

"You were critically injured," she said while she held the glass for me to drink. "You were on the surgical machines nearly six weeks." The way she said that, it must have been a local record. Not knowing how up-to-date their compudocs were, I couldn't judge. I had been critically injured before. It goes with the job.

"That makes it late July?" My voice was firmer after a drink.

"I've never been able to make sense of the old calendar," she said. "It's the sixth Monday of Summer." I had forgotten that Wellman used a cockeyed calendar of its own. With an even 364 days to the year, they divided it into four 13-week seasons. The sixth Monday of Summer sounded like early August.

"You'll be released in a day or two," Willa said.

"I get dizzy when I try to sit up."

"That will pass as soon as we get you on solid food," Willa assured me. "Medically, you're OK."

"What happens when I'm released?"

"Someone from the Office of Settlement will talk with you about that."

Office of Settlement sounded ominous, like *Committee for Public Safety*. Colonists choose names like that for "war crimes" tribunals, when they win. I thought about that while Willa hooked

me up to a compudoc. The exam took only minutes. Willa hadn't finished disconnecting the probes when she got the machine's verdict.

"Tip-top shape." She slipped a hand terminal back in her pocket. "And you'll feel that way once you get some real food in your belly. I'll have the kitchen send a meal right away."

"Right away" was five minutes. The food was decent and plentiful, delivered by the cook with a smile and a "Good afternoon." There was coffee with it, real coffee, not the ersatz we got on the ship coming from Dirigent. While I ate, I tried to make sense of my situation. I wasn't being treated like a prisoner. The nurse showed neither resentment toward a member of the army that invaded her world nor scorn for a defeated enemy.

The man from the Office of Settlement arrived just after I finished eating. He was old, likely not much past ninety, but he looked older—thin, mostly bald, slightly stooped. My impression was that it wasn't from age but from a lifetime spent hunched over a desk.

"Let's see"—he checked a hand terminal—"you're Janno Kepher?"

"It's pronounced *Hawn-no*," I said.

He squinted, then nodded. "Janno Kepher." He got it right that time. "Have you ever done any farming?"

Slave labor? It wouldn't surprise me. That's less wasteful than killing prisoners, and after the trouble they went to putting me back together, I really didn't expect to be shot.

"I'm a city boy. I don't know the first thing about farming." Well, I knew the *first* thing, that it was hard work.

"You'll learn. Our instruction programs are very good."

"Is there any alternative to farming?"

"Not at first. Everyone farms, at least until they establish that they have other skills that are in sufficient demand to support them, and even then it's customary to continue doing some farming."

Great. Trapped on a strange planet with little hope of escaping, I had to face a lifetime of farm labor. I was already forty-three. Nearly a third of my expectable span was gone. The idea of farming for eighty or ninety years made me wonder if I might have been happier without the compudoc. I know farmers are necessary, but it wasn't for me. The man from the Office of Settlement—he never gave me his name—stared at me. His slight smile might have been compassionate or mocking. I wasn't sure which I liked less.

"It won't be that bad." Patronizing was even worse. "Much of the work is mechanized. We're not totally primitive. I'll take you out to your farm tomorrow. Your wife is expecting you. She'll teach you what you need to know."

I puzzled over that and scarcely noticed that he left. As far as I know, all of the colony worlds speak the same basic language, but the dialectic differences increase with every generation. I wasn't sure what *wife* meant on Wellman, a slang term for slavemaster or whatever. The only thing I was sure of was that the word couldn't mean what it did to me. I didn't have a wife at the moment and my two ex-wives were

light-years away and wouldn't have explained the time of day to me on a bet.

By the time I finished my second meal, I felt pretty good. Wellman's compudocs were modern enough to include some physiotherapy. Maybe I wasn't at my fittest, but my muscles weren't completely flabby and my stomach hadn't atrophied. I could walk around longer without rest each time I tried.

My first trip was to the window, to orient myself. The hospital was a two-story building near the center of Wellman's only real town. From our briefings enroute, I knew a lot about the colony (though I suspected that much of the intelligence was wrong; the magnitude of our defeat was evidence of that). Wellman had been settled eighty years before and the population was estimated at sixty thousand, mostly confined to Grand Island—the size of Great Britain on Earth—just off the southwest corner of the planet's largest continent. The strait between them varied between three and seventeen miles in width. Perhaps one thousand settlers had moved to the nearer portions of the continent and there were "undoubtedly" smaller groups scattered at other sites—miners, primarily, out to exploit the most readily accessible ore deposits. That's normal on any colony world. Metal's too expensive to import in quantity. There was indigenous life, but nothing remotely intelligent. The native flora and fauna were considered "not incompatible" with Terran life. Wellman was choice real estate, and my regiment had been hired to capture it.

I had a lot to think about, but I slept

through most of the night and woke normally at dawn. My years as a soldier make sleeping-in almost impossible. The nurse hooked me up to the compudoc. The machine ruled that I was ready to be discharged. Then I got breakfast and new clothes—work clothes and shoes, plain underwear and socks. The well-dressed peon.

The man from the Office of Settlement arrived as I finished dressing. We left the hospital in a four-seat ground effect cart. Our conversation was limited to greetings and small talk. I had no trouble keeping track of where we were going. He lined up on a compass heading and went straight, only making a couple of minor detours around buildings and growing fields. Twelve minutes at thirty miles per hour—about six miles from the hospital.

"That's your home." The old guy lifted one hand from the control yoke to point. He slowed the floater and we moved down a dirt lane.

The house was one-story, about twenty by forty feet, with a steeply-sloped roof that hung well off the sides. There was a barn and a few smaller outbuildings, but I didn't see anything that looked like slave quarters. There were chickens running loose, a couple of cows in an enclosed pasture, and an animal that looked like a cross between a donkey and a kangaroo—a native animal, obviously—that seemed to have its run of the place.

We stopped thirty yards from the house's open front door. "You don't need me now," my guide said. "Your wife must have heard our approach." The GEM cart was noisy. "She'll teach

you what you need to know. Good luck.”

A dismissal. I got out and stood next to the path while the cart did an about-face and started back toward town. Then I walked slowly toward the house, looking around, nervous about the lack of security precautions. It was as though they were simply turning me loose and that made no sense at all. I might high-tail it for the woods and try to make a go of it on my own. Any trained Dirigenter could do that on any world with edible native food—or isolated farms he could raid.

I had covered half the distance to the house when the girl appeared in the doorway. She was in shadow at first, from the knees up. Tanned legs in soft mocassins. I stopped at the edge of the porch. The girl was maybe twelve years old, dressed in a simple ivory-colored dress, a shift I would have called it. Her hair was dark and wavy, shoulder-length, brushed until it was glossy.

“I’m Janno Kepher,” I said.

She took a step forward. “I’m Mayam.” *My-em*. “I’ve been expecting you.” She came forward another step, out of the shadows. The sunlight showed hints of red in chestnut hair. *Maybe thirteen*, I thought. The light revealed more fully-developed breasts. But she couldn’t possibly be older than thirteen.

“Is your mother around?” I asked.

Surprise crossed her face. “No, she’s at home. That way.” She pointed a little right of the line to town. “About eight miles. Why?”

I got a bit dizzy, disoriented, again. This time, I didn’t think it was from my injuries. The pronoun she used sank in. *She* was expecting me.

“The man from the Office of Settlement said my wife would be waiting for me, that she would teach me what I need to know.” It couldn’t be.

“And *you* will teach me what *I* need to know. I am your wife.”

It was. If I had gotten a whiff of mind gas it couldn’t have disrupted my thinking processes more completely. Dizziness, nausea, utter confusion. Apparently, *wife* hadn’t changed meaning.

“Are you ill? The hospital said you were recovered.”

“You’re just a kid!”

“I’m old enough to start having babies. That’s why I am your wife.”

That stripped away the last shreds of doubt. “How old are you?”

“I’ll be thirteen the tenth Tuesday of Summer.”

Twelve years old and she was supposed to be my wife? On Columbus, the world where I was raised, a man who had sex with a thirteen-year-old would spend twenty years in jail. In the mercenary camps of Dirigent, he would be thoroughly emasculated—handed his penis and testicles in a jar, left to pee into a plastic bag—and kept in penal servitude for life, doing crap-work around camp so his former comrades could draw the necessary object-lesson.

“You’d better come in and sit,” Mayam said. She took my hand and led me inside. A wooden settee with cushions faced an unlit fireplace. Mayam set me down and left me for a moment.

I looked around, somewhat numb. There were two chairs, a drop-leaf table, table lamp, overhead light, and plain curtains on the windows. Besides the front door, there were two others—to the kitchen and bedroom. Mayam re-

turned with a mug. She handed it to me and I drank—coffee laced with liquor. Mayam sat next to me, close, and watched my eyes while I drank and coughed at the surprise booze.

“What the hell’s going on?” I asked. “Back home, girls your age are playing with dolls and going to school.”

“I finished school this spring, and I gave my dolls to my baby sister,” Mayam said quietly. “I watched her being made and I saw her being born.”

I started to jump all over that line but couldn’t. Maybe I sputtered a little before anything coherent came out. “Listen, do you know who I am?”

“You’re Janno, my husband.”

“You know how I got here, what I am?” I was having reality problems. I had fought on a dozen worlds, spent a quarter-century soldiering, and now I seemed to be arguing with my worst nightmares.

“You were a soldier before,” Mayam said.

“I was part of the army that tried to conquer your world. We killed people here. Doesn’t that mean anything to you?”

“That’s over.” As closely as I listened, I couldn’t hear any resentment in her voice. *That’s over.*

“Isn’t anyone mad about it?” Thinking back, I may have screeched that question. The nurse, the old duck from the Office of Settlement, the hospital’s cook, Mayam—no one seemed to understand . . . unless their idea of revenge was more devious and sadistic than I imagined. Was Mayam there to tempt me into indiscretion—to be met by an enraged father and who knows what kind of *fitting* punishment?

I know, I wasn’t thinking clearly, but I had seen too many soldiers deballed for grabbing a little young stuff. Well, one would have been too many, but I suppose that in twenty-five years I stood in ranks to observe the punishment perhaps a half dozen times. Even when it wasn’t enforceable, the penalty was the same. It didn’t matter if the offense happened on Dirigent or in a newly-conquered colony. We remained under the discipline of the regiments.

“If you’re supposed to be my wife, how come there wasn’t any ceremony? And there has to be some kind of record.”

Mayam led me to the kitchen. There was a comp terminal on the table.

“We don’t have ceremonies,” she said, punching up a menu. “Select public records and enter your name.”

I did. The monitor showed two entries.

“*Six Tues. Sum. Janno Kepher, Immigrant, married to Mayam, daughter of Pender Morek and Kista.*”

“*Six Tues. Sum. Janno Kepher, Immigrant, Freehold tenant of Lot 17A39, NW Sector, SE Quadrant, 175 acres.*”

“You’re my wife and this is my property?” I had never heard of *that* kind of treatment for POWs.

“Isn’t that what it says?” Mayam asked.

“I expected to be treated like a prisoner.”

“We don’t need prisoners,” Mayam said. “We need farmers and fathers.” It was a rehearsed speech, but behind it I saw the first traces of doubt—or maybe it was fear—in her brown eyes.

“How do *you* feel about this? Did

anyone ask if this was what you wanted? If I was what you wanted?"

This time there was a hesitation before she answered, and the corners of her eyes tightened a little. "My father took me to see you in the hospital while you were being treated." *Unconscious, naked, and hooked into the surgical machines. A side of beef on a slab.* My gut churned. "He said you were a good soldier, that you would be a strong husband and give me healthy babies. I thought so, too. Am I not what you want?" There was a hitch in her voice with the question.

"How can I know?"

Mayam's first reaction to that blustery question was to bite her lip. Then, after just a beat, she peeled the dress over her head—she had nothing on under it—and struck a pose that didn't suggest childish innocence. I've seen seasoned whores on Dirigent strike similar poses when business was slow and they were competing with their sisters for what was available. Two large windows made it very light in the kitchen. Mayam had a dusty tan all over. She turned around slowly, then moved right up against me. She was scarcely five feet tall, but she tilted her head back to look me in the eyes. Her breasts pressed into my stomach, hot, like branding irons marking me forever, keeping the memory of how they looked fresh in my mind—not especially large, but full and firm, dark-peaked nipples, the breasts of a woman, not a child.

"Am I not what you want?" Mayam asked again.

I had to back away. I got dizzy again. For the first time in my adult life, I wanted to run as far and as fast as I

could. Twenty-five years of soldiering left me impervious to most things. But I considered eighteen a borderline age for a lover, even if it was a one-night stand for two-days' pay. Mayam wasn't thirteen yet, even if her body looked ready for the babies she was so damn eager to start.

I panicked. "How the hell can I know what I want? Thirty minutes ago, I didn't know you existed. Just for the sake of argument, what happens if I say you're *not* what I want?" I couldn't keep all the anger and confusion out of my voice.

"They'll find someone who *is* what you want, maybe one of the widows your soldiers made." Her control finally slipped and she ran from the room crying. I heard a door slam, but I didn't move until there was silence again.

Finally, a reaction I could understand.

"Proud of yourself?" I whispered. I started shaking and needed time to figure out who I was mad at—certainly not Mayam. She was only doing what she had been raised to do. Not at myself either. Maybe I didn't feel great about reducing her to tears, but—all things considered—I hadn't let off nearly the steam I had coming. Then I found a target: her father. What kind of man would raise his daughter to think she had to start breeding as soon as she started bleeding, have her watch to learn what to do, farm her out as soon as a man became available? With a focus, I could control my anger. When I could breathe normally, I sat at the comp terminal and called up the menu. It was awkward dealing with an unfamiliar

system, but there were plenty of help cues.

I didn't find a primer on local customs, but I found a lot of census data. The more I read, the farther my anger receded.

If Dirigent Intelligence had had access to Wellman's public net—but that's the catch. There's nothing harder to tap than the *public* net of a small colony. The colony is compact enough to only need one com-satellite with tight microwave lines to the surface. Even with good computers it takes time to sort through 10^{10} possible scrambler codes, and a world like Wellman didn't have enough ships coming in to cover the attempt. But *if* Dirigent Intelligence had had access to Wellman's public net, the brass would never have tried to take Wellman with one regiment. If the client—and I don't know who that was—wasn't willing to spring for the manpower to do the job right, the Council would have sent them packing. Despite the chest-thumping about one trained merc being worth ten draftees or fifty militiamen, the brass hates to press it. It's more economical in the long run to go in with clear numerical superiority, parity at worst. We were told that Wellman had 60,000 inhabitants. Using standard formulas (and I don't know how the formulas are formulated; I was just a noncom), our planners assumed a maximum of 12,000 men of "prime military age," less than one-fourth of whom would be able to respond quickly to a surprise attack. Part of the economics is to win before the enemy can really get into the game. What we, the grunts who land and fight, were told was as rosy as anything. With

Wellman's population concentrated on an island, a Blitzkrieg aimed at the main town and transport links would give us working control of the colony in one day, with negligible casualties. It didn't work, and I didn't need long to find out why. Our big shots seriously underestimated the population. *Seriously*. Wellman had 200,000 inhabitants, not 60,000. We didn't face 3,000 defenders, we faced 16,000. And they shredded us.

The colonists had obviously been heavily into reproduction from the start, and they were a fertile lot. The average age of girls at marriage was thirteen years and a few days. The average woman bore fourteen children. Infant and child mortality were minimal. Divorce was virtually non-existent. Widows and widowers tended to remarry before the flowers wilted on the graves of their late spouses. Longevity wasn't markedly lower than on more "civilized" worlds. Farming co-operatives gave everyone a good start and help when they needed it. And Wellman had scads of arable land waiting to be farmed.

The Ninth Regiment, Dirigent Mercenary Corps, expected to take Wellman in a day. The local farmers needed just six hours to annihilate us. I checked the reports. Thirty-seven hundred of us landed—crack assault troops, 80 percent combat veterans. Maybe three hundred managed to evacuate before the debacle was complete. Twelve were captured, all unconscious and seriously wounded like me.

It was good that I was alone when I read those reports. I cried like never before. My adult life, my friends, all

the family I really knew had been destroyed. I was an orphan.

I walked to the barn and back, slowly, looking around, trying not to think but unable to shut out the memories of soldiers I had trained with, fought and drunk beside. Comrades. Brothers. Ghosts now. When I walked back to the house, I wasn't the same man. I couldn't be.

Girls Mayam's age married and had babies on Wellman, routinely. That meant there was no local reason why I shouldn't go inside and give her what she wanted, and every local reason why I should. But the taboo was a lifetime old for me, and according to the terms of my enlistment, I remained under the discipline of the Corps as long as I was alive. If they returned, I might end up as one of those eunuchs. The technicality of a local marriage wouldn't mitigate the crime. If the Dirigenters returned and I was living with Mayam, I would have to fight on the side of the colonists. If I fought for Wellman and lost, I was a dead man, or worse. And if the Corps returned, it would be in real force. They wouldn't underestimate Wellman again.

I stopped walking. I stood in one place, staring straight ahead but not really seeing anything. But I could smell. Barnyard odors. I could hear. Barnyard noises. *Farming*. Mud and manure. Well, I was used to mud. I was a soldier, one of the best. Sergeant Kepher of the Ninth.

None of it made as much difference as I thought it would. I couldn't decide if the Corps were likely to return. The longer I thought about it, the less certain I was that I even cared. Even if the Ninth Regiment came back, reformed, re-

manned, it wouldn't be *my* Ninth. That was dead, regardless of what my enlistment papers said.

I found Mayam face-down on the bed, legs spread, head buried in a pillow, arms wrapped around it. At first, I thought she had cried herself to sleep. She didn't move when I opened the bedroom door. I stood in the doorway for several minutes and watched the regular rise and fall of her back as she breathed. I'm not sure I can reconstruct what went through my mind. All my life I had *belonged* somewhere, to someone or something—a solid family as a boy, the Ninth Regiment after that. But now?

I sat on the edge of the bed and put my hand on Mayam's shoulder.

"Mayam? I'm sorry I made you cry."

She opened her eyes, rolled over onto her back, and moved my hand to a breast. She was warm and sweaty from lying on the bed. "I'll be a good wife." She looked away for a moment and her fingers played on the back of my hand. "I'll be a good wife," she said again, but this time it sounded less certain. "My mother taught me well."

"I'm sure she did," I said—I had to say something. Mayam started stroking the inside of my thigh with her other hand.

"We make love now?" The tremor in her voice may have been because of the way I had reacted before. Or maybe she was really less certain that she wanted it than she claimed. Her hand got closer to my crotch on every pass, teasing, retreating. I leaned over and kissed her forehead.

"Not yet," I whispered. I moved her

hand from my leg and held it to keep her from going back to her erotic doodling. "You'd better give me a quick tour of the farm while it's light out." I suppose I knew which way I would go, but I needed more time to get used to this new situation, and unless we got out of the bedroom in a hurry . . .

Mayam's sigh was a bit theatrical, but *not yet* worked better than *no*.

"I'll get dressed." She sighed again as she got up and rubbed against me so I wouldn't forget what was waiting. She took a jumpsuit from a drawer, pulled it on, pressed the slide closed, then slipped into her mocassins. I wondered if she ever bothered with underwear but didn't ask.

Mayam's mood changed as soon as we left the bedroom. She started talking farming—non-stop it seemed. She got cheerful, bouncy, once she quit playing temptress. I didn't interrupt her monologue even though I didn't understand half of it. She talked about crop rotation, planting cycles, and the local co-op. We had crops in the ground that had been tended by the co-op pending my "arrival." The co-op didn't charge for that, but I would be expected to contribute time to working with other members on general projects like plowing and harvesting. There wasn't enough heavy equipment to go around, so what there was was used in common.

There was a utility floater in the barn. I drove and Mayam navigated. She knew her way around our farm, what was growing where, when it would be ready to harvest, how much we would get from each acre. Part of our land was in staples, part in pasture, part in truck—fruit and vegetables. The early

crops were in and preserved, and so forth. When we got back to the yard, she briefed me on our livestock—a dozen chickens, one sow with litter, three cows and two calves, and the semi-tame jackaroo, the animal I had noticed when I arrived.

Back in the house, Mayam sat me at the kitchen table and punched up "The Homesteader's Manual" on the terminal.

"You start that while I get supper," she said. Our three-hour tour left her feeling quite in charge. While I made a stab at working with the interactive manual, I also watched Mayam. Her lecturing had removed some of the little-girl air. She was self-possessed, confident. It would take a long time for me to appreciate how complex she was—nothing at all like what I imagined a girl her age could be.

"Everything we're having tonight comes from *our* farm," she said. "It won't always be like that, but this is our first meal together." Some mystical bonding process, I supposed. Supper was veal (three cows, two calves), new potatoes, sweet corn, green peas, fresh-baked rolls, and a raw peach brandy that could bleach your innards. Mayam drank hers heavily watered. So did I.

"I didn't see any grapes," I said after sampling the brandy.

"We don't have any. It takes years to get good vines working if you want them." She said that as though she had decades of experience.

"A little wine can be nice occasionally."

"Our co-op makes wine, but the people I've talked to don't like it. Do you know how to make wine?"

"I know a little about it. On Dirigent, I used to listen to an old vintner talk about his craft." That was an easy way to get free drinks when cash was short. Goby Hanks liked to drink and talk, but not alone.

"You could probably help at the cop's winery then."

"That's better than shoveling manure."

"Oh, you'll do *that*, too." Mayam giggled crazily. She was enjoying herself, playing at least part of the role of happy housewife. After dinner, I started to help with the cleaning up because I didn't know what else to do. I must have been more nuisance than help though because Mayam quickly suggested I check my "wardrobe" in the bedroom and let her finish.

There were plenty of clothes, and the ones I tried all fit. When I came out of the bedroom, I could hear Mayam putting dishes away and humming, sounds that recalled my mother when I was a kid at home. I stood in the living room for a couple of minutes, eyes closed, and listened. It started a sort of ache in my chest. Rather than go into the kitchen and disturb the dream, I went outside and sat on the edge of the front porch. My feet just reached the ground.

The sun had set a few minutes before. Like most of the colony worlds I had been on, Wellman had a rich night sky. The brightest stars were already visible, unfamiliar constellations whose local names I would have to learn for my own satisfaction. Mayam came out, stood behind me, and massaged my shoulders.

"Dinner was delicious," I said without turning. Maybe the compliment was tardy, but after so many years of mess

hall and restaurant food, I was out of practice at saying nice things about a meal.

"I like to cook," Mayam said quietly.

"Sit with me." I patted the porch at my side. Mayam sat and snuggled close. I put my arm around her and gave her a squeeze—a reflex, not particularly sexual.

"It's not going to be easy for me here," I said. I told her a little about Columbus and Dirigent, and my life as a mercenary. I really felt a need to talk about myself, and that's unusual. Maybe I was just trying to postpone the inevitable. I ended up talking about the punishment meted out to soldiers who had sex with young girls.

"You're not one of them now," Mayam said.

"The regiments don't like to lose. It's bad for business. If they come back, they'll consider me still one of them."

"There was a public meeting on the compnet here," Mayam said. "The governor said that the ones like you were abandoned, that you no longer had a world of your own, that you were victims like us." It was another transparent recitation. I wondered how extensive the coaching had been.

"Not many of us. I checked. Only twelve of us were captured."

"I think some died in the hospital," Mayam said. Then we were quiet for a time. Twilight slid into night. I heard insects chirping, and occasionally a bird flapped overhead as it hunted for a meal.

"We have a lot of work to do tomorrow," Mayam said—eventually.

I nodded, still not sure *what* work had to be done.

Another moment passed before Mayam said, "We should go to bed." I thought I heard a catch in her voice. I turned toward her, but her face was too indistinct for me to see any expression in the dark.

She took my hand when she stood, drew me up, and led me through to the bedroom. The house didn't offer much choice. Either I shared the bed with her or I slept on the floor. The settee wasn't nearly long enough. Mayam turned on the bedroom lamp—a low, warm, yellow light that encouraged dusky shadows. We stood there looking at each other for a moment, and I wasn't sure what Mayam expected. Maybe she wasn't either. She stripped off her jumpsuit and shoes, then she stepped closer and started to undress me.

She fumbled at the clasps on my shirt and her hands started to tremble.

"You wear too many clothes," she complained softly.

"It's what I'm used to." I finished the shirt.

When we were both naked, Mayam pressed against me and wrapped her arms tightly around my waist. Her whole body quivered and I don't think it was excitement. But after a moment she started squirming to move my erection around on her stomach. She pulled me to the bed and stretched up to kiss me. Her eyes were wide, the pupils dilated as far as they could be.

"You're really not sure about this, are you?" I asked softly.

For just an instant, I thought she was going to agree, or just start crying again, but she pulled me down onto the bed then and we kissed—wildly. She seemed driven, frantic to prove that she was

ready, *eager*, to fully be my wife. I had no trouble responding, though I had feared that I might. The taboo. But *my* regiment was dead. Whether this was what I would have chosen for myself or not, Wellman was my home for the foreseeable future.

Our first time was frantic. Despite the shaking and all, Mayam was in a hurry to get me inside her, to consummate our marriage. Her urgency was contagious, irresistible. At the start, I couldn't tell if it was panic or passion that was driving her, or just a little girl's way of playing grown-up. Before long, it didn't matter. She was Mayam. She was my wife. And I was too aroused to think beyond that. And then . . .

If her first time hurt, she gave no sign. Afterward, she didn't want to let go. She clung, keeping me inside her as long as possible, her face against my chest. A couple of times, her body convulsed as if she were suddenly chilled and shivered. A short time later, we made love again. I tried to slow the pace, but Mayam seemed less nervous and more eager to get through to the crazy time—and she did go a little crazy when her orgasms came, jerking and twisting as though electricity was coursing through her.

We slept tangled together, spent. Mayam whimpered a little as she fell asleep, but she wouldn't let go of me.

—And I was the one who woke shaking from a nightmare. The terror was too vivid. It started out pleasant. Mayam and I were making love, with her on top. Then the dream—and Mayam—changed. She got younger and younger, until she was a tiny baby bouncing on me. Then she was gone and I felt a sharp

pain in my groin. I reached down to ease it but there was nothing there. The Ninth had returned and turned me into a woman. A baby screamed, and—

The screaming was my own.

Mayam shook me awake and my pain was different. My body was denying the nightmare with an erection so full that it was agony. I rolled onto Mayam and into her without preliminaries. This time, I was the frantic one, mindless with the urgent need to put the lie to my dream. Mayam convulsed with one orgasm after another, holding on, caught up in my frenzy despite the tears flowing freely down her cheeks. But I couldn't find release. Panic drove me on and on. I was afraid that I might be hurting her but I couldn't let go for the longest time. And when I did, I collapsed and slept through total exhaustion, clinging to my child-bride.

When I woke, it was morning and I was alone in bed. My face was wet with my own tears. There was a knot in my gut, a burning ache lower. I felt depressed, miserable. I heard busy sounds from the kitchen, so I got up. The hot water in the shower was only warm, but it stayed warm so I stood under it until some of the aching faded. I towelled dry and went back to the bedroom to dress. Mayam came in while I was pulling on my shoes.

"Did I hurt you?" I asked. She was only wearing a jersey that wasn't long enough to cover everything. Her face looked pale. Her eyes were red. I guess I wasn't the only one who had been doing some crying.

"Not so much," she said in a pain-

fully-childlike voice. "You were frightened."

I got up and took her in my arms, and held her against me. "I'm sorry. That nightmare had me out of my head." We held each other. I don't know who was more frightened. Waking with tears on my face was scary in itself. A lot of things scared me that wouldn't have the morning before.

"Breakfast is ready," Mayam said.

I was hungry despite the knot in my gut, and breakfast was hearty farm fare. We didn't talk much until it was over.

"You were thrashing around in your sleep, screaming," Mayam said. "That's why I woke you." She came around the table and sat on my lap.

"I dreamed that my regiment came back and—and did what I said they do." Mayam put her head on my shoulder and wrapped her arms around me. She smelled fresh and sweet and nicely scrubbed.

"No wonder you screamed." I didn't see the irony then, the pubescent girl comforting the battle-hardened veteran. I wasn't accustomed to nightmares that made me scream. I closed my eyes and held Mayam, drawing what ease I could from her warmth. But not for long.

"OK, what's all this work we have to do?" I asked to avoid recalling the nightmare. Mayam gave me a quick kiss, then got up.

"There's always work on a farm. Give me ten minutes to do the dishes and pull on some pants and we'll get started."

Farming. It didn't take very long to support my instinctive dislike for the idea. Morning chores included feeding animals, shoveling out pens, and col-

lecting eggs. Mayam had already collected the day's eggs, and served them for breakfast. Then there were fields to inspect. Mayam had a schedule to make sure we looked at every part of the farm once a week, more often when necessary. "We saw most of it yesterday, so we can ignore that today," she said. We used that time to visit the local co-operative.

The co-op was a bit of everything—school, mutual aid society, social club, general store. We would buy supplies there and food we didn't grow ourselves, exchange our excess raw crops for processed foods. Every farmer in the area donated time to co-op projects—plowing, reaping, anything too big for one person to handle alone. The co-op milled grain, processed food, traded with other co-ops around the colony, and provided practical education for adults and children.

Argyll Potter was minding the store my first time there. He was thirty and had a laugh that threatened to bring down the roof whenever he unleashed it—about every thirty seconds it seemed. Mayam introduced him as a cousin and Argyll rattled off the thread of their relationship. It sounded more like he was the cousin of a cousin removed two or three times in different directions, but after eighty years of furious breeding, most of Wellman had to be related to most of the rest. Before he finished his begets, Argyll was talking about his own three grandchildren.

We set up a series of compnet lessons for me and scheduled my first shift with the co-op. Mayam said that I knew all about wine, so I would start at the part-time winery to see if I could find a way

to make something besides vinegar. I hoped I could. Beer's OK most of the time, and the co-op produced a decent brew, but I like a flagon of wine now and then. Mayam and I had lunch with Argyll, then drove home.

Mayam stripped as soon as we came in sight of the house. We spent part of the afternoon harvesting sweet corn from our garden patch. I husked ears that were longer than my forearm and Mayam started freezing them, except what she saved for our supper. As I was quick to learn, Mayam never wore clothes when she could avoid them. Her tan came from working naked, not from lying around. When she got sweaty, she could duck into the shower or take a dip in our pond. It wasn't until she started working in the kitchen that she put anything on, and then it was just a bib apron.

Later, while Mayam was fixing supper, I started my compnet farming lessons. Since I was going to farm whether I liked it or not, I had a lot to learn.

That night, we made love properly—slowly, tenderly. We both lost the frantic drive and nervousness of the night before. I had no nightmares, and when I woke at dawn, we were still holding each other. I didn't move at first, not wanting to wake Mayam. She looked so young and innocent, skin smooth, not a line or blemish, mouth slightly open, breathing softly. She seemed somehow magical, a pixie from some faery realm—not subject to the rules and limits of normal people.

Mayam. It's not enough to say that I didn't know there were people like her. I didn't know there *could* be people

like her. But it would be wrong to try to define her by our first couple of days together. I know I wouldn't like to be judged by those days. We were strangers forced together. But at what point can I say, "This is Mayam as she was"? Perhaps those first days do her less of an injustice than me. But my actions had to affect hers, and so forth.

A typical day? Maybe that is the only decent way since this must be an abbreviated account at best. Not a day picked at random though, or a blend of bits and pieces from several days like a memory built from spare parts, but a day I recall with some clarity, though I don't fully understand *why* that day stands out so prominently. But then, it hasn't been all that long ago.

We had been together about two weeks.

I woke with the first light of dawn, as usual—a habit that Mayam said meant I was a natural farmer. Each morning that first summer brought faint reminders of yesterday's labors—aching, stiff muscles that would loosen up when I got working again. Movement was the cure, but lying motionless in bed silently cursing the need to get up and do work I hated was more rewarding psychically. Mayam was still asleep, curled up in a fetal position facing me, hair hanging over her eyes. I stretched and relaxed several times to get the blood flowing and so forth, then rolled over to kiss Mayam. She didn't wake at once, but she smiled in her sleep and reached for me. When her eyes opened, she quit groping and settled for returning my kiss and smiling again. Sometimes we made love in the morning. Apart from the inherent pleasures of making love to

Mayam, morning sex stalled the start of the workday. But we had a fuller-than-usual day ahead of us. I needed time to start thinking about things like that in the morning. Mayam didn't. She jumped out of bed and I followed.

After breakfast, we got right to work. That morning, we started harvesting green beans. We had beans to see us through the next year, and extras to use in trade at the co-op. For the first couple of hours, Mayam and I picked beans side by side, stripping adjacent rows. It turned into a race, and Mayam's fingers were more nimble than mine. I had to satisfy myself with the consolation of swearing under my breath as I tried to keep pace. When the small cart we pulled with the floater was full, we drove back to the house and Mayam stayed to start the canning and freezing. I had to continue picking.

Walking the rows of beans, Mayam had been quiet mostly, saving her breath for the work, and for the pleasure of seeing me puff trying to match her speed. But as soon as she hit the kitchen, she started to hum a jaunty something-or-other as if she had all the energy and air in the world. I emptied the cart and trailer, carrying baskets of beans into the kitchen, dumping them on the table and in a series of small bins I had carried in from a shed the afternoon before, then loaded the baskets in the cart and trailer for the trip back to the fields.

"I'll be ready for the next batch by noon," Mayam said.

I mumbled something and drove off. My hands and forearms prickled from the fuzz on the bean vines and bushes. I already felt baked past the limit by the sun, and the morning was only half

over. And all I had was the soldier's usual outlet, swearing. Hot dirt underfoot. Hot sun overhead. I started picking those damn beans again, but I moved slower than before. I wasn't going to race my shadow. It didn't have muscles and bones and skin to ache.

After about thirty minutes, I just stopped. I stood up straight and tried to ease the pain in my lower back from all the stooping. I looked back down the row I had been working at the two full baskets between me and the floater, and at the half-full basket at my feet and the two empty baskets nestled under that. Efficiency. It didn't make sense to walk back to the floater every time I filled a basket. Start out with a stack of empties, leave each full one in place until you run out of baskets or beans. Pick up the fulls on the way back. I could carry two full baskets without trouble. The only reason I couldn't tote more was the awkwardness of the loads, not the weight.

I looked up at the sky. It wasn't nearly noon. I had at least another hour of picking time. Or any other kind of time. There was no shade close and what I really wanted was to get out of the sun and cool off.

"Eighty or ninety years of this?" I asked out loud. "I'll never make it." I looked toward the creek and the trees along it, maybe 500 yards off. It would be shady there, and cool. I looked beyond, at the nearest stretch of real forest, maybe a mile beyond the creek. Land that hadn't been cleared for farming yet. I remembered the thought that I had when I was first dropped at the house—about hightailing it for the woods and living in the wild until the Corps came back to avenge its humiliating

defeat. Wilderness survival can be rough, but standing in the middle of a half-picked field of beans, it held the lure of furlough in a soldier's paradise.

I have no idea how long I stared at the distant forest, but when I returned to picking beans, it was with the listless plodding of a soldier in the last stretch of a 50-mile march.

When I got back to the house with my load of beans, Mayam had lunch ready, ham sandwiches, fresh potato salad, and a full pitcher of lemonade. She was still humming, keeping right up with her work. She still looked happy, even though she was working at least as hard as I was. I didn't say much while I was there and Mayam didn't try to force conversation. She could tell that I was in no mood for chitchat.

When I brought in the last of the beans about four o'clock, I was dirty, grumpy, aching, and ready to exhaust my considerable vocabulary of obscenities, vulgarities, and assorted oaths at the slightest provocation. Mayam was still cheerful, and that would have just aggravated my mood except that she was sweating rivers—working over the stove was as bad as working under the sun—and her hair was matted down from steam and sweat. Her apron was soaked and clung to her. But the work went on. I helped finish the preserving and then we took a break for a quick dip in the pond and a shower afterward. Mayam chased me out to the porch then so she could start fixing a full supper.

"Why don't we just have sandwiches?" I suggested. "It's been a devilish day for both of us. Take it easy for a change."

She made a face. "With all the work, we have to eat right to keep up our strength."

"Hey, you have to ease off *some-time*," I said.

Mayam shook her head. "It's *our* land. If *we* don't do it, *who* will?"

I dozed while she cooked. I dozed while she did the cleaning up after we ate. It's a surprise I didn't drop off on my supper plate. She still wouldn't let me help with the clean-up; I got chased out to the porch again. When she finished we sat together on the porch for a while, and damned if I didn't doze off again. When Mayam shook me awake, night had settled firmly around us.

"We'd better get you to bed or you'll sleep out here all night and be useless in the morning," she said.

I groaned and stretched, and managed to wake up enough to say, "OK, but I'd better warn you now, I'm going to be useless in bed tonight."

She giggled madly and said, "We'll see about that!"

Oh yes, we did. It wasn't just that she was young and I wasn't. I always kept myself in top condition. There was no room for flabby noncoms in the Dirigent Mercenary Corps. It's just—I don't know, Mayam seemed able to draw on resources I never had. Like that night. She had to do most of the work in bed, but we managed, and after we finished, sleep was a massive void that swallowed me whole and held me down until morning.

Two weeks later, Mayam told me that she thought she was pregnant. She was more than a week late. We went to town the next day. An examination at the

hospital confirmed Mayam's pregnancy. She was ecstatic.

My reaction was more complex. My first thought was, *I didn't know you still had it in you*. I had one son, twenty years old. I hadn't seen him since his mother and I divorced when he was three, hadn't heard anything of him since he was ten. Junior and his mother moved off-planet when her second husband, a captain in the Twelfth, accepted a permanent garrison post on one of the older colony worlds—Hargrave or Commonwealth, I think. And my second wife wanted no part of motherhood. There was no special drive to increase Dirigent's population. Once I got past the stud-like feeling of accomplishment, I worried about Mayam—barely thirteen and pregnant—despite the fact that Wellman was used to pregnancies among girls her age. I worried about how it might complicate our still-growing relationship. I worried that it meant I would never be able to look at the distant line of forest with quite the same feeling of being able to chuck the farm for the wild. I needed quite a while to get to the just-plain-happy stage.

We came home from the hospital with a special program module for our comp terminal and with attachments to make it a remote link for the hospital's OB compudoc. Twice a week I hooked Mayam up and the compudoc did its work and told us Mayam was doing fine and either confirmed or adjusted her diet and exercise regimen. We took lessons on how to deal with the pregnancy and delivery, possible complications, and how to care for the baby when it came. First-time expectant mothers are moni-

tored *very* closely since they're usually Mayam's age.

During the next few weeks, a strange thing happened. Sex had been our way of saying goodnight and occasionally good morning, but once we learned that she was pregnant, we became insatiable. One day, a couple of weeks after we found out, Mayam finished her exam, I disconnected the compudoc, and we made love, "stealing" time from chores. Mayam got on top and afterwards, I eased her down, held her to my chest, and ran my fingers up and down her spine. She liked that, even though (or because) she was so ticklish that it sometimes set her to squirming madly. She pulled herself up to kiss me and I whispered, "I love you."

Mayam jerked up to arm's length, surprise on her face. "That's the first time you've said that." It seemed impossible, but I guess it was true.

"So I'm dense. I needed time to figure it out." Thinking about it, right then, I decided that I *did* love her—as far as I understood the word and what it's supposed to stand for.

Mayam came back down and snuggled up to me. "I love you, too," she said, and we made love again.

I waited until later to start worrying about how this new complication would affect me.

Two days later, I made my first trip to town alone. I had an appointment with the colony's governor, Jordan Eders. The governor serves a single two-year term, and the co-ops take turns providing someone to handle the unwanted job. The governor heads what little government Wellman has, and he

is *ex officio* commander-in-chief of the militia that includes every male between sixteen and eighty. Of course, no females are risked, not on Wellman. The governor's office was stuck off in a corner of the corrugated metal shed that the Council of Co-ops uses for its three-days-a-season legislative sessions. The rest of the year, the building is used for livestock auctions, dances, and shows. The animal smell was overpowering even though there were no animals currently quartered in the building. Jordan Eders's door was open and a fan was blowing out, trying to keep the animal odor at bay. Jordan was standing at a window when I arrived. I knocked on the door jamb and he turned around.

"Come in. You're Janno Kephher?" I nodded and corrected his pronunciation. "Sorry, Janno. Have a seat." We both sat. He was about my age, bigger than me, and dressed in similar work clothes. "What can I do for you?"

"The Dirigent mercenaries may return," I said. "If they do, it will be in a lot more force."

"I know. You have something particular in mind?"

"I've got a baby coming. I wouldn't want to see the Dirigenters come back and win." I told him about the penalties for statutory rape. "I've got twenty-five years' experience with the Ninth. The other survivors and I should be able to help the militia. No matter how easily you took us before, the next attack will be a different story."

"Do you think they will come back?" Jordan asked. I shrugged. I still didn't have an answer for that.

"You're the third man to come in with the same worry. But then, you

were the most seriously injured of the survivors. The others were out of the hospital weeks before you.”

“They could come back with ten times the troops, with fireships to soften us up first. At a guess, I’d say they might land commandos first—anywhere from a couple of platoons to a full battalion—to scout the terrain and prepare a few surprises. They could land anywhere on the planet and move in whenever they please.”

“We can detect any vessel entering our space,” Jordan said. “How do you think we managed to get ready before?”

“Can you spot a single scoutship coming from an improbable direction, bound for an unlikely landfall?”

“If we can’t, it’s too late to do anything about it. We’re not due for a supply ship for fifteen months.” Interstellar traffic might be fast, but it’s expensive. Routes that don’t show a profit get only the minimal service guaranteed by the colonial charters. Wellman still didn’t produce anything compact and valuable enough for its trade to be profitable.

“I’ll do anything I can to help,” I said. Since I was already liable for the Corps’ punishment for statutory rape, I didn’t see much reason not to add desertion and giving aid and comfort to the enemy.

“I’m glad you came in.” Jordan got up and stuck out a weather-roughened hand to shake. “Some of our people weren’t sure that our decision to welcome the few of you who survived was wise.”

“You hedged your bet shrewdly enough.”

He grinned. “*That* was accidental. We didn’t know anything about the

mercenary world. It’s just that we get so few settlers that we worry about the restricted nature of our gene pool. The eight of you who survived are precious to us—new blood in the most literal way. Our real concern was that some or all of you might have been psychotic. Mercenaries.” His voice did strange things to the word. “But the compudocs assured us that the eight of you had no dangerous chemical imbalances or genetic pre-dispositions to concern us.”

Jordan walked out to the floater with me. The way he talked about those of us who survived started me thinking that maybe the others didn’t die from injuries sustained in battle. And I wondered if the machines had played around with anything else, like our minds. But I didn’t ask. I didn’t let on that I was the least bit suspicious.

“You’ll be assigned to a militia unit shortly. Every co-op has one. Our intelligence people will have questions, too. Once our computers analyze the memories of the eight of you, we may have a better idea how to protect ourselves next time.”

“One question, something nobody bothered to tell us before the attack,” I said. “Why in the name of Earth would anyone pay millions of ounces of bullion to take Wellman?”

“Sand.” I’m sure my puzzlement showed. “I can’t give you a proper scientific explanation,” Jordan said. “I’ve seen the reports and I didn’t understand a lot of the jargon. But we have a freshwater crab in the lower reaches of most of the rivers here on Grand Island and across the way on the continent that chews sand, digests it, and turns it into shell, an organic silicate nobody ever

saw before. The research done here and on samples we shipped to Earth hints that it may be the most valuable material in the known Galaxy.”

“I don’t get it.”

“The report we got from Earth — probably the same report that led to the invasion, somebody on Earth must have leaked it—says it will revolutionize electronics, power transmission, and hyperspace travel, and no one’s been able to synthesize it.”

“If it’s that valuable, the regiments *will* be back,” I said.

Jordan nodded his agreement.

The next months sped by but Mayam and I kept so busy that, looking back, it seems that we crammed years of work into the last half of summer and the first half of autumn. If I had more time, I could give a week-by-week account of Mayam and her pregnancy, but that would blow this account completely out of balance. There was nothing markedly abnormal about it. Mayam was no more moody than my first wife had been when she was pregnant with Junior. Perhaps no less moody either. Still, Mayam did as much work as the compudoc allowed, and *that* was more than I would have thought wise. Me, I learned farming through total immersion—the active work I hated, and formal lessons I learned to dislike almost as much. But when I had a question or a problem, help was only a compnet call away and freely given. At the winery, I helped improve the sterilization techniques, guessing that extraneous bacteria were the most likely cause of the quality problems. Apparently, I was right, because we took special care with that fall’s

pressing and the new wine was quickly declared the winer’s best ever—if not yet great. The summer crops were harvested, autumn crops planted. Harvest-time industries cranked up to full speed. The promise of winter’s slack time was still in the future.

You work a full schedule and you think you couldn’t find a single minute to do something extra. Something extra needs doing and you squeeze that in, and the next thing. People from our co-op helped with the work when military duties started to cut into my time, but most of them had military duties of their own.

I was commissioned a lieutenant, even though the highest I rose in the Ninth was company lead sergeant. I spent hours talking about my military service. It wasn’t like a POW interrogation. The sequence was split up over many weeks, in person and on the compnet. There was no way I could recall every detail of twenty-five years in the Ninth, but I dredged out what I could. When the militia got into serious training after the harvest, we were able to train for a lot of the Ninth’s stock of tactics. And the others like me, scattered around the colony, did much the same thing.

It felt good to be back in the army.

We drilled and trained weekend afternoons, and spent one evening a week in class, either at the co-op, or over the net. Our uniforms were the same kind of work jumpsuits we would wear on the farm when the weather wasn’t too hot for that much cloth. But we wore patches identifying our unit and rank, and that made them uniforms. The militiamen were mostly in top physical

condition. Most had been in the militia for some time. They had the morale boost of knowing that they had already beat off a regiment of professionals. And they knew that when they fought, they fought to defend their homes and families. It made them quite a formidable unit.

Winter wasn't really cold on Grand Island, but slow, chilly rains hit frequently. Farm work goes on. No matter how miserable the weather, there were animals to feed and care for, lessons to learn, schedules to plan, gear to repair. But the time needed to maintain the farm in winter was less than in summer. Mayam and I could take a day or two at a time to putter around the house or just relax. Only the animals needed attention every single day.

I finally got to see the crab shells that were our source of danger and our promise of future prosperity. My militia battalion went on a three-day exercise on the coast, along the strait that separates Grand Island from the mainland. The militia unit of a fishermen's co-op threw us a banquet the evening before we were due to return home. After wandering off to find a latrine to get rid of some of the beer, I walked around to clear my head. The last few months hadn't given me any opportunities for heavy drinking, and I was out of practice. I heard sounds of work behind a shed that reeked of decades of dead fish. A young man was sitting at a long table. There were a number of shells that looked like shallow bowls on the table and on the ground around him. The largest were well over a foot in diameter. The young man looked up as I approached.

"You're with the visiting troops," he said, spotting the silver lozenge sewn on my collar. I nodded and introduced myself.

"Teller Verdeck," he said. "You seen these before?"

"No, but if they're the sand shells, I've heard about them."

He handed one to me. "Hold it to the light."

The sun was near the horizon. I held the shell out to cover the disk of the sun. The shell weighed less than I would have guessed. It was translucent, almost transparent.

"Set it on the ground," Teller said. I did. "You're hefty-looking. Jump on it—both feet, hard as you can." I looked at the shell. It seemed terribly fragile, glasslike. "Go ahead. You can't hurt it."

I jumped. the shell gave a little, but not much. When I picked it up, I couldn't see any damage.

"Now come and look at this."

Teller was working with the flat part of another shell. He used a glass cutter and carefully scored a line. Then he turned the shell over with a pair of tongs and scored the other side, parallel to and an inch from the first score.

"This is the last side," he said. He propped the shell against a metal bar, along the lower score, and clamped it in place. Then he tapped the shell hard with a narrow-headed hammer above the other score. The already-thin shell separated between the lines leaving a *very* thin edge. The larger piece was roughly an equilateral triangle four inches on a side.

"I've edged it all around like this," Teller explained. He put a military

gauntlet on his right hand, slid the triangle to the side of the table and picked it up gingerly, almost fearfully. I shook my head. That armored gauntlet was virtually impenetrable. Teller flipped the shell at the shed twenty feet away the way a boy might skip a stone across a pond. The shell bit into the wood wall.

"Go take a look. Use these to pull it out." He handed me the tongs. "Be damn careful. You've never seen a blade half as sharp."

The shell was stuck in halfway from one point. I pulled it out with the tongs and set it on the table.

"Impressive," I said.

"Not the half of it. See this?" He held up a small bottle of brown liquid. "This is the juice the crabs use on the sand and bits of old shell. We've figured how to milk 'em for it. They build new shells several times while they're growing. When they use the juice on raw sand, they get these shells. Watch what happens when they recycle old shells."

He dripped liquid on the triangle—just a few drops—turned it over and poured a few more drops on the other side. The shell wilted in seconds, like a cabbage leaf. Teller rolled it into a small ball with his hands and bounced it on the table. The ball flattened.

"If it dries slow in the sun, it's like ceramic, hard but brittle. Then the scientists started playing around with it and found some really strange properties."

"Like what?" I couldn't help but be curious.

"I don't know all the story. They keep finding new stuff, depending on how much juice they use, how they dry the mix and so forth. The big deal though is that when they freeze-dry the

recycled mix at -40 degrees, the stuff turns into what they say is the best superconductor ever. And it stays that way after they take it out of the freezer. At *any* temperature."

I was glad to get home to Mayam. I worried when we were apart. There was almost no violent crime on Wellman, but accidents can happen very easily on an isolated farm. Mayam was well into her sixth month and getting awkward. The farther along she got though, the younger and more innocent-looking her face seemed. When she met me at the door when I got back from the coast, she triggered an odd set of memories from Dirigent.

For a few years, way back when I was a private in the ranks, we got an unusual number of recruits from the religious colony on Archangel. You can always find a few religious types in the ranks, but those lads from Archangel belonged to the Church of the Christian Mysteries. They all carried small pictures or figurines of Mary the Mother when she was pregnant, almost at term. "Immortal God in the womb of mortal woman, *that* is the central mystery," they said. Their icons always showed Mary as very young. Like Mayam.

"I've got a kettle of stew simmering, since I didn't know just how late you'd be home," Mayam said when we got inside. She pointed at the fireplace.

"How'd you get that kettle hung?" I asked, too sharply.

"I carried it," Mayam responded defiantly to my challenge.

"You know you're not supposed to lift anything that heavy."

"It was empty then."

Not that *that* made much difference. The kettle was cast iron and held five gallons. But I didn't want to quarrel, so I put my arm around Mayam and got her settled at the kitchen table. It was already set.

"I'll bring in the stew," I said. She didn't argue.

It was a quiet meal, not what I expected after being away for three days. We didn't argue, not beyond the tizzy over the stew kettle, but we didn't do much else either. I'm not talking about sex, particularly. The bigger Mayam got, the less of that we could do.

Generally, it was a good time for us, minor exceptions aside. Even with my absences with the militia, we had more time and less work than in the summer. We liked to sit in front of the open fire after supper—Mayam always naked, me in whatever I happened to be wearing. We talked, but mostly we just stared at the flames. I'd have an arm around her shoulders. She always put my other hand on her swelling stomach and rested her head on my shoulder. I'd rest my head on hers. Sometimes we both fell asleep like that.

The rains stopped in the seventh week of winter—"on schedule" I was told. A week later, the fields were dry enough to start the winter plowing. I took a regular turn with the co-op team, going from farm to farm. Mayam and I also set seeds in cold frames ready for transplanting when spring arrived. Getting an early start on some of the vegetables would give us two full crops a year from some fields.

A good time—and then the alarm came.

* * *

The alarm was a screech in the night from our comp terminal, in the last week of winter. While I read the basics of the sighting off the screen, my CO was on the speaker ordering the battalion to report to our "second alternative staging area," ready for indefinite service. War was returning to Wellman.

"I'll drive you," Mayam said, pulling on a jumpsuit. She cut off my instinctive protest before I got it started. "I need the cart while you're gone, don't I? If something happens, I have to be able to get to the hospital or co-op."

I wasn't happy with the idea of her driving at night with an invader on the way down, but she had a point. Help might only be a call away, but with mobilization, help might not come fast enough in an emergency.

"Promise you'll be extra careful," I said.

"I will," Mayam said, more meekly than usual. She was in her eighth month and I never knew how she would react.

I brought the floater around from the barn and loaded my weapons and gear. Mayam was ready to leave without anything over her jumpsuit, but I had anticipated that. I had her heavy, lined poncho waiting.

"You can't risk a cold now. Just think how miserable you'd be with the baby sneezing in there." I patted her stomach and Mayam laughed.

"First thing in the morning, get on the net and check your emergency contacts and schedules." With the majority of Wellman's female population routinely pregnant, trying to get pregnant, or recovering from childbirth, the mobilization schemes all went into great

detail on support services for the women and children.

It only took us ten minutes to drive to the rendezvous point. The mob scene there was more orderly than it appeared. We rehearsed often enough. Mayam and I said our goodbyes quickly and she drove off, getting out of the way. All four of Wellman's major troop carriers were waiting for us. Together, the planes could carry one full battalion—360 men—with equipment and food for a week.

My stomach tightened when I realized that we would be the first in.

There was a briefing for officers—a little more information than had been in the alert bulletin. A single ship had gone into orbit around Wellman. It didn't show the normal electronic markers of a commercial transport and didn't respond to the queries of our traffic control system. A smaller vessel, apparently a shuttle, an assault lander of a type I knew could hold eighty equipped troopers, had separated and was heading for a landing point 300 miles away, on the mainland. An hour by air for us. More troops would follow us in, a second battalion as fast as our transports could get them to us, and additional reinforcements "as needed." The fishing fleet was assembling to ferry across soldiers, too, if they were needed.

We boarded as soon as muster was complete and the planes took off within seconds of each other. I spent the time we were in the air talking to the men of my company, trying to relieve anxieties, trying to give them some idea of what we would face. It was a routine I was used to, talking on the way to a

combat landing. I had done it often enough over the years.

"Are you scared, Lieutenant?" one of the younger privates asked as I moved down the aisle past him.

"Always. It would be stupid not to be," I told him. "The idea is to use the fear. It can keep you alive, keep you from doing stupid things. Cherish every bit of that fear you find. Just don't let it freeze you up." Talking was my way of dealing with it going in. I have to think that my pep talks have helped a lot of soldiers make it through battle alive, but I wouldn't be surprised to learn that I get more out of my pep talks than anyone else.

I didn't want anyone getting overconfident. Three hundred and sixty of us were going in after about eighty professionals. And Wellman had beaten 3,700 mercs the last time. We would land near the invaders at dawn and try to surround them before they could hit us or scatter. One lander meant that it was only a scout force. They would be pioneer troops, commandos. Dirigent Pioneers are an elite among the elite. They only accept combat veterans, and those candidates are put through incredibly punishing training. What it meant was that they would be the most deadly adversaries we could possibly face. We might have trouble finding them if they didn't want to be found—unless we bottled them up immediately on landing. If we didn't contain them, they could wreak havoc for ages.

Our lead plane landed less than two minutes after the unidentified shuttle. The Dirigenters had chosen their zone of operations with the sense I would expect. The area was geographically

chaotic, near the edge of a string of young mountains; there were areas of rock debris bordered by savannah and forest. Our other planes circled until our landing zone was secured. Then the rest of us went down. The plane crews dumped us, and our supplies, and took off. Except for the first plane down, they were on the ground less than ten minutes.

The first company in had established a perimeter and sent out the first patrols toward the Dirigenters. As the rest of us arrived, we formed up and started out behind those lead patrols, hurrying. The plan was to ring the invaders before they could disappear and keep them pinned down near their lander until our second battalion arrived. Then we would have enough strength to force the issue. If the Dirigent Pioneers refused to surrender (assuming that was what they were, and DPs have *never* surrendered), we would proceed to the bloody finish.

We were already on the ground, marching toward the Dirigent shuttle, when two more landing craft separated from the ship in orbit. With our own reinforcements two hours or more away, that changed the scenario completely.

I was nineteen the first time I saw combat. That time, I mistook fear for excitement, and it bothered me that I was looking forward so to action. And then I looked through my gunsight and pulled the trigger and saw men I shot bleed and fall. Later, I saw my closest friend from training die at my side. He took an exploding bullet just above his left ear when he turned to say something to me. It wasn't until after that first firefight, when I had a chance to thoroughly

clean off the blood and gore that had spattered me, that I learned that I had also been wounded, cut a dozen times by bits of bone blasted from my friend's skull. After that, there was no excitement, just the fear. I recalled that baptism every time I headed into combat afterward.

When we got the news about the two additional shuttles coming down, I went to Malc Odere, our battalion commander.

"We've only got one chance," I told him. "We have to try to wipe out the first batch before the second gets in place behind us." He looked at me as if I had just pronounced a death sentence for every man in the battalion.

I wasn't sure I hadn't. "Look, right now, we have a nine to two advantage," I said. "Once those other landers get down, our margin will be cut to three to two—and that won't make it, not against Pioneers."

Malc hesitated just an instant longer before he started issuing the orders. I barely had time to get back to my men before our little corner of hell opened up.

Briefly, the revised plan called for one company to spread out and hold half the circle we had drawn around the first mercenaries while our other two companies attacked. It was what we had originally planned, but now we had to do it in a hurry and with only half the manpower, because the Dirigenters's reinforcements would arrive before ours could.

My platoon was near the right flank, where forest was trying to encroach on the rocky scree below a crumbling rock face. The Dirigent shuttle was out

ahead of us, beyond the last of this stretch of wood. We were spread out, moving forward in two staggered ranks, trying to cover a front that was too wide.

Then the shooting started and there was no time to think of anything beyond the moment. We pushed on, running almost doubled over and shooting wildly. I saw movement ahead, a familiar camouflage pattern, and I slowed enough to fire a controlled burst that must have found its target. I didn't have time to realize that I had probably killed my first Dirigenter, someone with some claim to my loyalties.

But when the grenade exploded, I did realize that a tree trunk was absorbing the load of shrapnel that would have minced me as it did several of my men. I heard the distinctive sound of a large branch cracking, then I heard nothing, for a time.

And then I heard silence. It might seem that there is no practical difference between being unable to hear sound that does occur and hearing the lack of sound, but it was that distinction that brought me back from unconsciousness knowing I had been unconscious. The silence was brief, but when it ended, there was no gunfire to be heard. For a few moments. When the shooting did resume, it was lighter, farther off.

I needed that time. I can't say how long it was. It could hardly have been more than five minutes and may have been less than one. But I needed that time to travel from the very edge of awareness to being able to do more than listen and, in some attenuated fashion, think.

Before I opened my eyes, I had the sense of being alone. I wondered if any

of my men had survived, if they had given me up for dead. My head throbbed. Pain entered my consciousness and I groaned.

"There's a live one," someone said. I didn't recognize the voice. I willed my eyes to open, but that seemed to take forever.

"Well, slit his throat and let's get out of here," a second unfamiliar voice said.

My eyes opened part way and I found my own voice.

"Wait." I didn't have much time. Only Pioneers on a commando run would treat a wounded enemy so cavalierly. "Ninth Regiment. Lead Sergeant Janno Kepher. Captive." Talking hurt, but I wasn't sure that they heard me, so I started to repeat myself. "Ninth Regiment—"

"OK, Sarge, I hear you," the first voice said, much closer.

I got my eyes open a little farther. He was squatting next to me but his face was out of focus. "They grabbed you the other time?"

"Yes."

"How many prisoners did they take?" The fate of the Ninth would be of major interest for everyone in the Corps. That was easy to see. A disaster like that would have an irresistible fascination. *That could have been us.*

"Only eight," was all I could get out. I coughed and each spasm felt like it was tearing my head apart.

"Just relax." He gave me a sip of water and that helped. "We'll get you back to the lander. The captain will want to talk to you when he gets here."

I closed my eyes. I had achieved my immediate goal. My throat would go



unslit at least a little longer. I hadn't had any chance to think beyond that.

The two Pioneers picked me up and carried me between them. The first minute or so was agony, but then something happened and the pain disappeared. I guess I crossed some threshold. My mind remained alert, perhaps more so than it had been since the explosion, but it was as if it were no longer connected to my body. I had a chance to do some thinking.

I was wearing what passed for a militia uniform and I had been found with the bodies of some (at least) of my men. In itself, that might not be an insurmountable obstacle. The uniform: available clothing. I had been held by the locals, forced to come along so they could continue to pump my brain for information. With drugs. There's no crime in talking under that kind of duress. There's no defense against it. Once I convinced the captain who was coming of my bona fides, the Pioneers would make sure I got back to Dirigent. Having an eyewitness account of the last hours of the Ninth would be important. If only . . .

My mind came fully awake then. The physical pain returned, but it wasn't as extreme as before. I could feel the soldiers carrying me by my armpits.

If they didn't learn about Mayam, I could be home free, back in the Corps, a hero just for surviving and making it back. They might even give me a commission. *Might?* Probably. No more farming.

I coughed and cleared my throat.

"I think I can walk now." My voice was stronger but it still didn't sound like

my own. The two soldiers were quick to take me at my word.

"It's not far now, Sarge," one of them said.

"Thanks." I coughed and hacked, trying not to make much noise, but I wanted them to think that talking was still difficult. I blinked several times and tried to see where we were, but nothing would come into focus yet.

I got about five steps before my knees gave out and I started to fold. I felt like I was crumpling in slow motion. There were hands hoisting me again before I got all the way down.

"Let us handle it, Sarge. You must have taken one hell of a whack. The side of your head's all bloody." I thought about Otter Deese, the friend who got spattered all over me so many years before. For a moment, I thought it had just happened. I started to shiver, cold all over, thinking of the brains and blood stinging me so forcefully.

The other one said, "What company of the Ninth were you in?"

That snapped me back. "Company A, Third Battalion. Captain Jacks. We had the rearguard here." Then it was time for more coughing to end the immediate questioning. I didn't have to coax the cough, though. It came all by itself. I had a lot of hard thinking to do and I didn't know how much time I had.

There were a few more Dirigenters at the edge of the woods. The shuttle was fifty yards out, aimed back across the prairie grass, ready to take off at need. My companions hauled me to the shuttle and set me on the steps that folded down from the open hatch. I was in the shade, at least. They gave me another drink, and then joggled off to

report to their sergeant, off by the edge of the trees.

My vision was starting to clear, but it was far from perfect yet. And if I had realized how fuzzy my thinking was, I would have been scared out of my mind, petrified, afraid to make *any* decision. There was no mirror handy to let me see my head, but the rest of me looked pretty ragged. Quite a bit of my jumpsuit had been torn away, including the web belt that had carried my pistol and ammunition. That was a blessing. They couldn't tell I had been armed.

I had a ticket back to Dirigent, to the Corps, to the Ninth. All of my fears about what the Corps might do to me were pushed aside. There seemed to be a good chance that they would never learn about my statutory rape or my willing cooperation with the Wellman militia. I could escape the beanfields and cornfields and the rest of the damned fields. No more farming. No eighty or ninety years of slaving at work I detested.

But that would also mean no more Mayam, and the thought of losing her *did* start its own ache. I would never see Mayam again. I would never see the baby that was due in a few weeks.

What choice do I have? I asked myself. *I couldn't escape if I wanted to. I can barely move with help.* I could move my arms and legs. I shifted to a more comfortable position on the fold-away stairs. It hurt, but I could move. I sure couldn't run, couldn't overpower uninjured Pioneers. What choice *did* I have? I could tell the truth and hope that they would be satisfied with just killing me without performing the other operation first. Or, I could try to fake it and

get to Dirigent as a hero—with, perhaps, an ache that would never leave me. And no guarantee that the truth wouldn't eventually be discovered.

What choice?

"We radioed the captain," one of the men who found me said. He damn near ran back to tell me. "The other landers will be down in twenty minutes. The captain said to get you laid down and tended to as best we can. Come on, you'll be more comfortable inside."

He half-carried me up into the shuttle and got me stretched out across the front seats of the troop compartment. "We don't carry much in the way of medicine. All I can do is stick on one patch for the pain and another to perk you up a bit."

I nodded, I think, and he put the patches on my neck and used some water to clean away the blood on the side of my head. "It doesn't look all that bad, cleaned up," he said. "Concussion. Maybe a fracture in there. We get you up to the ship, they'll fix you right up, good as new."

"Won't be the first time," I mumbled. In the background, I could hear the radio in the shuttle's cockpit, just a couple of steps away. The transmission was in a voice code I didn't know, but it seemed to be the pilot of this lander giving instructions to the pilots of the two shuttles that were coming in.

"I'll see you later, Sarge," the man who had treated me said. "Hang tough. We'll get you home yet." He left. The patches started to work within seconds. Less pain, more thought.

Home.

What choice?

Then, I started to think that maybe

I *did* have a choice. The question was, was it a real chance and did I want to take it. Questions. Plural. I sat up and leaned forward, getting my head down a little when I got dizzy.

Mayam and farming, or Dirigent and the Corps?

I looked around the compartment. I didn't have much time to make my decision. I was inside their lander. Not alone, true, and I couldn't do much physically. Not without surprise and a weapon. If I could take out the pilot, I might even be able to play the hero for Wellman. Those landers are armed, rockets and machine guns, to take care of any contingencies on the way in or to strafe defensive positions.

It had been a lot of years since I last changed a squalling baby, and I hadn't done it often at that. I wanted to now. And I wanted to get back to Mayam and make more squalling babies with her. With *her*. If I could.

The Pioneers didn't leave much in the way of weapons behind. There was a stack of disposable rocket launchers. I couldn't shoot one of the damn things inside the shuttle unless I wanted to blow the whole thing, including me, to hell, and I didn't know if I had the strength to use one of the tubes as a club.

But there wasn't anything else.

Once I started, I would be committed. I would be throwing away any chance of making it back to the Corps even if I failed. And I couldn't waste any more time trying to figure odds or change my mind.

When I stood up, I almost fell down. The pain was bearable, my mind seemed clear, but that didn't negate the physical

damage that had been done to my head or the blood I had lost. I blinked and tried to clear the dizziness, breathing slow and deep to get oxygen flowing. After a moment, I could move, as long as I kept it slow. To the rack of rocket launchers. To the cockpit with the blurred door frame.

The cockpit door was open and there was just the one pilot, in his seat, watching a radar screen and talking into a microphone. He didn't have his helmet on, which was a relief. And, although his image was blurred, I could tell which part was real and which was the ghost. He heard me behind him and turned. There wasn't much room to swing the yard-long rocket launcher, and I couldn't get a lot of force into it. If I hadn't fallen forward behind the blow, the pilot probably would have stayed conscious, might even have been able to duck. But I stunned him at least, and I used his boot knife to finish the job.

I took the pilot's pistol and staggered back toward the outer hatch. The automatic sealing mechanism started the hatch closing when I pushed the button. I hoped none of the troops would hear the noise and recognize it until I had time to gimmick the lock. I smashed a couple of circuit breakers. They would need a long time to get in without blasting a hole in the shuttle and I *hoped* they would hesitate a long time before they made the shuttle unspaceworthy. They were going to want to keep their ticket off the planet intact. That was my theory anyway.

By the time I worked my way back to the cockpit, I could see the black dots of the shuttles coming in to land. They

don't need a lot of room, but they can't come down vertically.

There was only one major question left. I wasn't sure that I could fire the rockets without the main engines being on. Past that, I *did* know how to operate the weapons systems. Any noncom in the regiments had to know that. Arm the system, line up the target acquisition radar, lock in the guidance system, and hit two buttons for each rocket. Two targets, two rockets.

I heard pounding back at the hatch. The Pioneers knew that something was wrong. But they couldn't tell what I was doing inside. I don't think they figured it out soon enough. The rocket system worked on the ground. And the backblast from the rockets stopped the men who were trying to get in.

The incoming shuttles? Well, it's nice to have weapons that can't miss when you really need them.

I suppose I could stick in a bunch of nonsense here about how I singlehandedly stood off dozens of Dirigent Pioneers for hours, but that's what it would be, nonsense. They did hesitate long enough about blowing a hole in the side of the lander to let *our* reinforcements arrive. I don't know much in the way of details, because I was unconscious most of that time.

After that, it was just a matter of disabling the last lander so the DPs couldn't use it to escape before we had a chance to move it to Grand Island for our use, and hunting the Pioneers who had escaped the ring from the first lander. Brief firefights, ambushes, hit-and-run skirmishing. I missed that, too. While we brought in another six battalions of

militia to do the hunting, I spent three days on a compudoc in our field hospital. Then it was time to go home.

My lead sergeant and I had eight families to visit when we got back to Grand Island, families of men who didn't make it. We made those visits together before I went home to Mayam.

Mayam met me at the door. She didn't run out to throw herself in my arms or anything dramatic like that. She looked as though she had gained twenty pounds in the four days I was gone (she hadn't, of course) and she was moving slowly. She cried a little when we hugged. Maybe I did, too.

The next alarm came in the middle of the night, too, four weeks after I came home from the continent. This time it was different. Mayam shook me awake. It was her time. I might have been in a complete panic if not for the thorough lessons and often-repeated drills (the same kind of repetition the military relies on to keep soldiers from panicking when they hit combat). I called Mayam's mother and she came over to help. With the supervision of the compudoc, we delivered our daughter. We hardly needed the remote link. Granny knew the routine. She was halfway to her fifteenth baby.

That was three months ago, Adgie. I started writing two weeks after you came in squalling, using the only free moments I could count on—like now. I'm at the comp terminal. When I look toward the living room, I see your mother sitting naked on the settee, holding you to her breast. For the most part, she's already regained her trim figure

(as she puts it). You're sucking down your last feeding of the evening, as greedy as ever. If you leave anything, maybe I'll try a taste later, when we go to bed. Mama likes that. Maybe this will even be the night we start your first brother or sister. Mama's eager and the compudoc says it's OK. Funny thing, I always thought a woman couldn't get pregnant while she was providing milk. Nobody here ever heard of that. Maybe it's the supplement the hospital provides. Maybe what I heard was just an old wives' tale.

By the time you read this, you may have heard many of the stories. I plan to hold off and give you this record when you're expecting *your* first baby. But maybe I'll have to reread it myself when you're twelve and eager to make your mother a grandmother when she's twenty-six—and I'm feeling protective and thinking like a Dirigenter again. If I'm around to be protective.

That isn't certain. It never is. That's why I'm writing this now, in case I'm not here to bore you with old stories as you grow up.

"But what happened to the rest of the commandos?" I can almost hear you getting this far and asking that, perhaps indignantly. "What about their ship in orbit?" "What about the mercenary world, and the sandshell crabs?" You'll be thinking that I'm a terrible storyteller, leaving so many questions unanswered, even, "How could you ever *think* of leaving Mama?"

Yes, there are a lot of questions. The last time I checked, we had accounted for seventy-two Dirigenter Pioneers from the first lander. We're still looking for the rest. There were no survivors from

the other two shuttles. We chased off their ship with a rocket that might not have damaged it if it had hit, but Dirigent thought we didn't have *any* missiles that could reach an attack orbit. What's next? I don't know. Maybe the Corps will take the hint. Maybe not. As long as we have something other people want, there will be danger. It doesn't matter if it's crabs, or gold, or farmland. All we can do is stand ready to defend our homes and families. Always. Whatever it takes.

The last question I've posed for you may be the hardest for me to answer. I loved Mayam, perhaps more than I had ever loved anyone else. I knew she was special. All the good things. But no one can be sweetness and joy *all* the time. Your mother can be moody at times—petulant, sulking. By the time you read this, I imagine you'll know that firsthand. Back there in those moments when the lure of returning to Dirigent tempted me, I didn't think so much of the love, the good. What popped into my head were the exceptions, the times when Mayam exasperated me with her "moods." For a while, until my mind cleared a little more. Blame it on the fractured skull. I chose to stay, and *that* should tell the story.

I'd like to tag on a "they lived happily ever after" ending, problems solved, danger past, but that would make this a faery tale. The story goes on. I'm doing my part, and next time, I won't even be tempted by Dirigent. In time, you'll do your part, even if it's only making your mother a grandmother at twenty-six and a greatgrandmother at forty. Maybe that's a long way off, but I'd bet that Mayam will still be making

babies of her own then, and for as long after that as she can. Maybe we'll be a little safer. We'll have more people, more frequent calls by trading ships, stronger ties to Earth and other colonies. We'll be a harder nut to crack. The ship that's due in about three months will help. It will bring satellites to give us earlier warning of attack, surface-to-or-

bit missiles that work, weapons, parts for another transport plane. It all helps.

I'm going to close off now. Your mother just stood up. You're asleep, finally. If you don't start fussing when she puts you in your crib, it'll be bedtime for us too.

And, eventually, we'll sleep. ■

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Jay Kay Klein's **biolog**

● The appearance of Roger MacBride Allen in *Analog* marks a watershed of a curious type that could seem significant only to those who have been attracted to the genre for over 50 years. He was born just eight days before the first man-made object orbited the Earth. Thus, he almost certainly is the very last *Analog* author, chronologically, to pre-date the Space Age. And then, in just a dozen years, he'll be a left-over from the previous century, helping push this magazine uphill towards its hundredth anniversary.

Roger's science fiction is thoroughly attuned to the hi-tech era where young'uns casually hack a computer through its paces, or even simulate a deep sun-dive as casually as earlier *Analog* readers once twisted a radio dial or forced a Ford V-8 into a parallel parking spot. His first two stories here were in May, 1986 and April, 1987. For writers, this is sort of like becoming a millionaire before you're thirty. The second story got the cover, too, after the first won the annual reader's poll for best short story of the year.

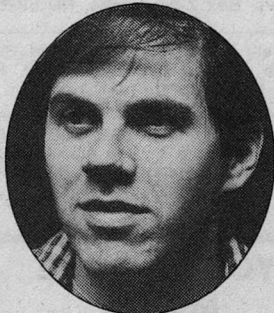
He comes from the old industrial heartland of America, the Connecticut Yankee territory of Bridgeport. Where once a humanities course of studies would scrupulously be kept untainted by any association with "stinks" and "electrical cracklings," Roger's journalism major resulted in a Bachelor of Science from Boston University. BU would not even hand him a delayed diploma until he'd paid local room and board fees for the time he was away in England on a work-study program. Well, this was the place that tried to kick out Isaac Asimov because

he was spending too much time writing books.

Roger is a full-time writer, too, practically all science fiction. His father, Thomas B. Allen, writes novels and non-fiction, some published this year and last. Together, they are working on a novel involving canonization of a saint and a Soviet spacecraft crashing in the U.S. Roger's first novel appeared in 1985 from Baen Books, followed by a sequel the next year. His third book, *Orphan of Creation*, came out in February. His fourth, *Farside Cannon*, is slated for August.

Like most of the writers who appear here, Roger never let classes interfere with getting an education. As a result, he has been mistaken for a scientist in half-a-dozen disciplines. His science fiction certainly shows he gets the facts straight, while the human relationships and individual actions are also handled with rigorous precision. He's seen too many stories where the spaceship or future city is worked out in great detail but their characters are cut from cardboard, jerking about in response to some typewriter in the sky. To quote a review of the just-out *Orphan of Creation*: "This book goes a long way toward doing for anthropology what *Timescape* did for high-energy particle physics, humanizing it. . . ."

Roger lives in Washington, D.C., which he likes for its cultural and research resources. You might meet him at several East Coast SF conventions this year, and some further afield. ■



Roger MacBride Allen

Analog Science Fiction/Science Fact



ORIGINS

Harry Frank

The trouble with trying
to reconstruct evolution
is that many paths can lead
to the same destination.

Actually, there are still quite a lot of us. Fewer than a century ago, but certainly more than at any other time in history. Most of us really look quite ordinary, and those who have ancestral features don't go out much. Others have jobs that keep them pretty much alone, particularly if they work nights. It's not that we're afraid of being "discovered," mind you. There are too many of us in positions of influence to worry about genocide. (Political maneuvering is one of the arts we contributed to your way of life—and we haven't taught you everything.) Besides, we tend to live in rather cosmopolitan circumstances; more likely we'd be pestered to death by booking agents from "Donahue" or "Oprah" than hunted down by frightened villagers. No, actually it's more habit than anything else. Habits die hard with us, but my sense of history tells me that this is a time of change. Twice in the past our numbers declined, even as they decline today. We survived by change. The world is smaller now. We can no longer avoid your strife and folly by retreating to the mountain backwaters or walking quietly among you. Your ways are as inexorable as they are destructive and profligate. We see the world through different eyes. We have a different vision. If we come forth openly perhaps you will listen. Perhaps we won't precede you into extinction. But first you must understand us. The villager mentality lies close beneath the surface. . . .

I felt the pilomotor prickling at the back of my neck even before I heard the fire siren. It was several miles from campus. Good strong voice, unimagi-

native melody. I was humming as I climbed the stairs toward the cool, gray comfort of the Life Sciences Building.

The ventilating system created a faint breeze from the direction of my office. So, they finally got around to repainting. The interior consultant said they might. I sniffed and narrowed my attention while I fumbled for my key. The methyl compounds were distinctive of the sample she'd called "Desert Sand," but there was a subtle fruity overlay. Ah, yes. The "Honey Oak" stain. Probably trim. I'll have to mention how nicely the "Honey Oak" compliments the "Desert Sand." Apparently quite different from the "Aqua" that the office used to be painted. Be odd if I didn't make some comment about the change.

A blur of movement caught my attention. At the end of the hall, in the secretarial suite, Miss McAlister was holding a telephone in one hand and waving frantically with the other.

"Dr. Windil. I didn't know if you were coming in today. Jerry Hirschfield's on the line. From *Physical Anthropology Quarterly*. . . ."

"I'll take it in my office."

". . . Anyhow, Bracket's on a dig in Kenya so I can't get the revised manuscript to him and expect it back before deadline. With the spring semester just over I was hoping you might have time to arbitrate."

"Can't you hold off on a decision until Bracket gets back?"

"The editorial board wants a quick decision. The next issue is a Neanderthal theme issue."

"What if I disagree with Bracket's review and recommend publication?"

I've never known *Quarterly* to go against his wishes."

There was an uncomfortable pause at the other end.

"Well, you're the current authority on the 'Neanderthal problem.' I'm sure they'll defer to your decision."

Over Bracket's dead body!

"In other words, you're hoping I'll concur with Bracket and get you off the hook with the board."

Another long silence. I sighed.

"All right, send it along. By the way, who's the author?"

"A young fellow from SUNY. Albert Warden. D'you know him?"

"I thought Warden was working on Australopithecine dental anatomy."

"Actually, it was some of his Australopithecine data that got him into this. You'll see how he ties it in when you read the paper."

... Although the fossil evidence therefore remains inconclusive, other avenues of investigation permit more definitive evaluation of current hypotheses concerning the origins and status of Neanderthal man. Thermoluminescence dating and faunal analysis leave little doubt that the anatomically modern skeletons at Jebel Qafzeh are older than any of the "classic" Neanderthal remains found in the same region, and may even be contemporary with the earliest Neanderthal specimens on record. The hypothesis that Neanderthal man was an ancestral "phase" in the evolution of modern humans is clearly incompatible with these findings.

Recent mitochondrial DNA analyses suggesting that modern humans evolved wholly in Africa (and subsequently ex-

panded to Europe and Asia) would likewise seem to eliminate the "Preneanderthal" hypothesis, which assumes European evolution of modern man and proposes that "classic" Neanderthal was an offshoot of this evolutionary line.

The DNA data also contradict the "Presapiens" hypothesis, that Neanderthal and modern man evolved as separate species from ancestral lines that diverged at least 250,000 years ago: If modern man evolved in Africa, then "classic" Neanderthaler must have evolved from the so-called "progressive" Neanderthals who inhabited Europe 250,000 to 150,000 years ago. This inescapable implication, however, cannot be reconciled with the evolutionary trend toward "modern" skeletal features that characterizes European specimens of this era.

*We must therefore conclude that none of the traditional scenarios provides an adequate account of Neanderthal evolution. Indeed, we are prepared to argue that comparative dentition and facial morphology (See Appendix I), analysis of superficial brain anatomy based on cranial endocasts (See Appendix II), and various paleoecological reconstructions of social organization and hunting patterns (e.g., Geist, 1978) suggest that Neanderthal man may not have evolved from hominoid, or even primate, ancestry at all. It is proposed instead that *H. sapiens neanderthalensis*, though anatomically man-like, was a product of convergent evolution from canid ancestry and should be properly identified as *Canis sapiens neanderthalensis*. If modern man is a "naked ape," Neanderthal man was a "naked wolf."*

I laid the manuscript aside and stretched. The subsequent discussion was logically organized and well documented. It cited every relevant source (and a number of irrelevant sources) from Hall and Sharp's *Man and Wolf: Evolution in Parallel* to Lieberman and Crenlin's analysis of Neanderthal's vocal tract. Warden didn't catch the wolf-like characteristics in Ibn Fadlān's description of "the eaters of the dead," but he mentioned Clrichton's retranslation of the work, and that may be adequate. Well done.

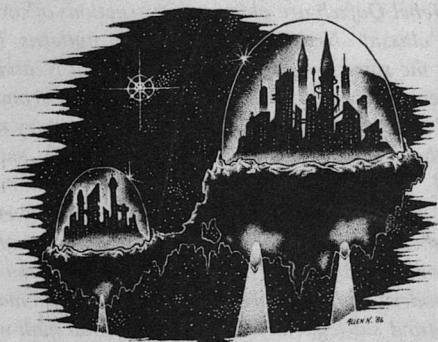
I carefully checked the box marked "Recommend Publication Without Revision" on the referee's evaluation form and picked up the telephone. Our roots may be in Europe, but we're no more territorial than you. And we stay in touch. It was early in Nairobi, but it took the overseas operator only ten minutes to put through my call. And then it was done.

It's sad about old Bracket. He built much of his reputation on his Neanderthal research. I suppose it was inevitable that he should then use his reputation to keep contrary views from being pub-

lished. But his time—like the time for secrecy—is past. Warden will have to address Bracket's substantive criticisms, certainly. The editorial board will insist on that, if only out of respect. Perhaps they'll even dedicate the Neanderthal theme issue of *Quarterly* to Bracket's memory. That would be nice.

In an odd way I'm also sad for Warden. He's right, of course, as far as he went. And if his scenario is incomplete, well, one revelation at a time is sufficient. Someone else will unravel the mystery of Neanderthal's sudden "disappearance" soon enough. Warden has provided the essential clues. But it really is a pity that he can't be told just how close to the mark he is. It would be some measure of compensation for the ridicule he's going to get. On the other hand, he'd have to be told that we rejected *Canis sapiens* over a century ago. A majority felt *Canis proteus* to be more appropriate, not to say whimsical.

But enough work for one night. The hour grows late. Time to get out of my clothes. The full moon rises in less than an hour—as it will rise tomorrow in Kenya—and paws are ill-suited to zippers and buttons. ■



the reference library

By Tom Easton

Farside Cannon, Roger MacBride Allen, Baen, \$3.95, 384 pp.

Consider Phlebas, Iain M. Banks, St. Martin's, \$18.95, 467 pp.

Alien Child, Pamela Sargent, Harper & Row, \$13.95, 247 pp.

Wheel of the Winds, M.J. Engh, TOR, \$18.95, 377 pp.

Day Seven, Jack M. Bickham, TOR, \$17.95, 314 pp.

Eternity, Greg Bear, Warner, \$?, 400 pp.

Rendezvous, D. Alexander Smith, Ace, \$3.50, 288 pp.

Perihelion, William F. Wu, Ace, \$3.50, 173 pp.

The Toynbee Convector, Ray Bradbury, Knopf, \$17.95, 275 pp.

Crown of Stars, James Tiptree, Jr., TOR, \$18.95, 340 pp.

Angry Candy, Harlan Ellison, Houghton Mifflin, 17.95, xxviii + 324 pp.

Cover artist Alan Gutierrez, or perhaps his art director, could not possibly have read Roger MacBride Allen's **Farside Cannon** before he did his work. I say this because he has presented a ground-hugging, dug-in scientific base on the far side of the Moon as a futuristic city of domes and towers. I say this because he has presented communication lasers, redeployed and readjusted to shoot down a threatening asteroid, or a warhead, as emitting crooked worm-track lightning bolts surrounded by glowing hazes meant to suggest the immense power of the lasers. And as *everyone* knows, certainly as Roger MacBride Allen knows and explains very painstakingly in the book, laser beams are straight, not crooked, and furthermore are invisible in vacuum, such as obtains on the far side of the Moon.

Since I know Allen knows better, I imagine that he has been fulminating ever since he saw the cover proofs, crying out that there should be qualification exams for artists and art directors, testing that they know enough to tell a

screw-up from a screwdriver. Perhaps there should even be qualification exams for the editors and publishers who supervise the work of the artists and art directors. Stan Schmidt, of course, would pass with flying colors, being a physicist by training.

I could go on, but I won't. Instead, let me tell you about the story Gutierrez so sadly misrepresents. It's not bad, the sort of thing that might go very well in this magazine, offering a technical solution to a technical problem posed by perfidious nasties. Those lasers on the cover are *not* approved by the powers that be. Rather, the story's hero, Garrison Morrow, and his sidekick Ben Moscowitz, have realized that an automatic laser-maker (a half-von Neumann machine—it doesn't duplicate itself, but it does duplicate some simpler machine, and endlessly) need not be turned off once its assigned task is done. Once the array of communication lasers is up and running, the factory can keep on churning out the zappers until the malcontents at Farside Station are ready to save Earth, declare independence, and assure freedom and justice for all, or something like that.

Save Earth from what? It gets interesting, folks. As the story opens, Garrison, his lover, Cathy Cleveland, and Ben, are in northern Iceland, looking for the remains of the asteroid that extinguished the dinosaurs. The corporation LuTech, which is moving the asteroid Cornucopia into near-Earth orbit, tries to stop the research, fearing that if Garrison et al. find what they seek, they will also scare the public into stopping LuTech, which will then go bankrupt. However, even though it turns out that both Cathy and Ben are spies, and one of them is a saboteur, our heroes succeed.

On the other hand, LuTech manages

to brand them as crackpots, and they can't get the word out to the public until Cathy convinces Garrison to let her anti-tech masters sponsor a videotape. That videotape, once thoroughly doctored, scares the pants off the public and thoroughly discredits Garrison's legitimate warnings of danger from Cornucopia. To work at all, they must go to the Moon, where *everything* is for sale (including one's rights to due process and free choice of employment) and they are promptly maneuvered into exile at Farside Station.

Meanwhile, Cathy's group, wanted by the cops, has also fled to space. Their goal is not the Moon, but Cornucopia, which they will divert from its orbit. Cathy hopes to save Earth. Her boss, a slimy Yellow-Peril Japanese fellow, apparently has other plans; they may even include crashing Cornucopia into the planet.

And that's all I'll tell you, except to say that Allen may seem to go overboard on his portrayal of the masses and bureaucrats as yahoos, but then again, so do the newspapers. As I write this, our Navy has just shot down an Iranian airliner, mistaking it for an F-14 fighter.

The last time I reviewed anything by Iain M. Banks, it was to call *Walking on Glass* queer, bizarre, slow, introspective, character-focused, not very commercial in the common U.S. sense, and quite satisfying. Now he brings us **Consider Phlebas**, an intricate space opera with bizarre touches. It pays somewhat less attention to character and more to commerciality, and though this makes the book a very different sort of thing from *Glass* it, too, is very satisfying.

The hero, Bora Horza Gobuchul, is a Changer, one of a variant subspecies of far-future humanity with the ability

to change, with effort, their physical form. They make valued spies; they can also escape any bonds, given time.

Horza is also an agent of the tripod al Idirans, alien religious fanatics at war with the largely human Culture, which pushes artificial intelligence and human-machine symbiosis so far that Horza fears that humans will become mere vestigial appendages to their machines. As the story opens, he has been caught. Now he is chained in a cell that is inexorably filling with sewage. But the Idirans arrive in the nick of time to give him a new mission: A fugitive Culture Mind (a huge, artificially intelligent super-computer) has taken refuge in the bowels of a curious off-limits planet, and Horza must try to fetch it out for his Idiran masters to study.

Now the Culture attacks the rescue ship. Horza escapes only to be picked up by a pirate ship which hauls him off to high adventures elsewhere. He must loot a miles-long Megaship at sea in a junior Niven-ring, survive the ship's accordioning collision with an iceberg, meet an obese cannibal, disguise himself as the pirate chieftain and flee the ring with all the Culture's guns trying to enlarge his tailpipe. And then, finally, he can get back on the track of his mission.

There is cliff-hanger after cliff-hanger, derring-after do, raging space battle after spine-tinglingly narrow escape. It sounds like suspenseful, exciting, active fun. Unfortunately, the marvelous far-future technology with which Banks studs the story is often distracting, though it alone makes the story possible. Equally unfortunately, some of the scrapes Banks puts Horza into are just too ludicrous or bizarre or gross to believe, and the suspense falters.

Is the ending ever in doubt, as it should ideally be? It wasn't for me, but

then I spoiled that aspect of the suspense by reading the appendices too soon. If you can refrain from peeking, there should be at least one surprise awaiting you at the end of what is, despite my few quibbles, a very enjoyable read.

Pamela Sargent's **Alien Child**, says the jacket flap, is for ages 12 and up, young adults and older. The writing is fine—tight, deft, evocative, and sympathetic to the age—and the point of the story is one which must matter to young people on the verge of freedom from their parents and responsibility for their own lives. Yet I found it hard to get excited by the story.

The reason may be that the story is a very explicit allegory, and it carries most of its freight of meaning on that level, rather than as more active incident. The child Nita believes that she is the only human on Earth. The only human faces she sees are on screens, dredged from the memories of the Kwai-lung-Ibarra Institute, a repository for frozen embryos. The only flesh she sees is that of her guardian, an alien named Llipel. Another alien, Llare, occupies another wing of the Institute, but neither Nita nor Llipel sees it; it is not their time to be together.

Nita used to be one of the Institute's frozen embryos, until an exploring Llipel goofed and triggered the machinery to bring her to life (birth, you see, is an accident). Explorations of the databanks reveal that there was a war, and that the world may well be empty (solipsism is a philosophy of the young). But then Llipel has the machinery thaw a cat for Nita, and Llare turns out to have been raising a boy, Sven, all along (other people *do* exist). Nita and Sven meet, dance back and forth in sexual attraction and aversion, and take their first steps toward maturity. In time, they realize

that they will not always have their guardians with them. The world is theirs, and the consequences of all their actions lie before them.

Alien Child is thus a tale of discovery. There is no grand orgy of action and violence, no journeys except the local, no quests except the internal, and the mystery of the empty Earth plays a definite second fiddle. I suspect it will suit best those young people with a taste for introspection.

M.J. Engh was lauded royally, if belatedly, for his *Arslan*. Now he offers us **Wheel of the Winds**, and I seized it eagerly, hoping for something as good—no, better!—for writers are supposed to learn and to stretch their powers as they go on.

My hopes were not fulfilled. *Wheel* is less inventive, less compelling, and less satisfying, even though it has a nifty premise and an ingenious world on which to pursue that premise. The world is tide-locked to its sun, though it wobbles; one side is therefore always bright, one always dark, and a broad band between the sides varies seasonally in dimness. Since hot air rises, winds blow from darkside to lightside. Waters flow in the same direction, and there is a civilization on the banks of a major river, the Sollet. The people are humanoid, though larger than ourselves and more used to cold.

Now appears a strange humanoid alien, shorter, shivering, amnesiac, an Exile from some far land. He is imprisoned by the Warden of a castle, but he escapes, flying on the wind with wings made of his blankets. The Warden is downriver, idling, between bursts of flak for giving him the blankets, with a friend, a ship-captain. The Exile appears, they drag him on board, intending to get him back to his cell. A govern-

ment snoop appears, pursuing rumors that the Exile has been seen nearby, and they flee downriver.

And the tale is off. It is, quite simply, a tour of this world of Engh's devising. They find strange people, lands, and beasts, surmount obstacles, and pass from light to dark and light again, from water to mud to land to water again, from plenty to privation to plenty again. Along the way, the Exile's memory returns and his tale emerges, slowly and in fragments. By the end, we know for sure what we have suspected all along: he is a human starfarer, less shipwrecked than disaster-stricken while on a mission.

That mission, and the interconnections Engh takes great pains to make clear for his world, reflect Engh's sense of and concern for the environment, just as did *Arslan*. The details are marvelously and intricately worked out. The characters are strangely named and sympathetic. But the drama that supports the theme is far too thin. You, as I, will be sorely disappointed.

How many of you have wondered? The *Challenger* explosion. The Delta blow-up. The eruption last spring of a solid-fuel plant. The paralysis of the U.S. space program, hamstrung by re-creation and risking avoidance while the Soviets, for one, go merrily on their methodical way into orbit and, in due time, beyond. How they must chortle at us in their beards! How they must congratulate themselves as they think that the KGB could not have arranged things more neatly to their advantage.

Or could it be? Might the KGB, or some other agency of undercover nefariousness, perhaps one acting for Japan, or China, or Europe, have arranged it all? Plots and treason and sabotage,

the stuff of fiction and, at times, of real life.

If that's the reason for our paralysis, no one knows, or if they know, they're keeping quiet. But fiction writers can act out their speculations freely, and Jack Bickham has apparently chosen to express ones much like those I voice above in **Day Seven**.

Granted, he says nothing about the recent past. What he does say is that in the 1990s, humans will detect a weak signal from Mars. In response, the U.S., the Soviets, and the Europeans will all mount expeditions to investigate and to seize whatever secrets might lie in wait. The first two expeditions will be manned; the third unmanned. The Soviets launch first. The Americans are rushing to catch up. But a psychiatrist, treating NASA's training chief for anxiety, uncovers something strange when his patient is under hypnosis. And then his patient dies, his office is ransacked and his receptionist murdered, he himself is mugged, and the clues that something is seriously amiss begin to mount up. Because the psychiatrist's daughter is one of the Mars-mission astronauts, he investigates, even signing himself into a private psychiatric hospital he suspects of programming NASA personnel to destroy the mission.

Bickham lets us know early on that the Europeans are responsible, in unholy league with Third World terrorists. He shows us the destruction of the Soviet mission. Our suspense is not over what is going on, but over the fate of the American mission. Will the intrepid shrink escape from the hospital in time? Will he learn enough to identify the triggerman buried in NASA's Mission Control? Will his daughter survive? Will the mission make it?

Because the answers are entirely predictable, I cannot rave about the book.

Still, many will surely find it a satisfying thriller.

Three years ago, I reviewed Greg Bear's *Eon*, which presented a marvel of technological wonder—the Thistle-down, the asteroidal anchor for the Way, a tubular, habitable tunnel that wound, spaghetti-like, through all of infinite space-time, touching all worlds and allowing humans, or their alien foes, the Jarts, to open gates on those worlds. I wasn't entirely enthusiastic, for I felt that Bear spent too much time detailing his technology.

Now we have the sequel, **Eternity**, and once more I am less than entirely enthusiastic, and the reason is similar: Bear, quite simply, crams too much stuff into an admittedly large package. There is the tale of Rhita, granddaughter of that Patricia Vasquez who fled the Way of *Eon* for a more peaceful alternate Earth; now Rhita takes her grandmother's gate-opening tools to the university, where she hopes for an audience with the Empress; eventually, she opens a gate and releases upon her world the alien Jarts, who wish no more than to package all sentients, all worlds, and deliver them to their ultimate descendants at the end of time. Meanwhile, the people of the Thistle-down, which originated in another alternate Earth, have closed off the Way (in fact, when *Eon* ended, they had just scoured it clean of all usefulness), and the characters we met in the previous book have grown old and frustrated in aiding our world in its post-Armageddon Recovery.

But—Olmy has found a Jart personality buried in a hidden computer file and taken it into his own implant-strengthened brain to study, despite the risk that it will take him over. Or will he find that the Jarts are perhaps too

similar to the Thistledown culture? Never mind, for Pavel Mirsky, who had fled the end-of-*Eon* disaster down the Way toward infinity, has returned with a message from the end of time: the Way is a cosmic hairball that must be destroyed. And . . .

Enough. *Eternity* requires some familiarity with *Eon*. If you enjoyed the first volume of the duo, you'll enjoy the second. If you didn't, you may still enjoy this one, for it does neatly wrap up the whole ball of string, and the characters do seem better realized. Or it may drive you nuts. Bear doesn't ask you to choke down a technological hairball this time, but he has crowded a lot into his 400 pages.

Rendezvous is another sequel, this time to D. Alexander Smith's *Marathon*, in which humans established radio contact with an alien species, the bluebears, and set off to meet them in empty space halfway between home systems. *Rendezvous* is the tale of that meeting, and especially the tale of how a collectivist, scent-oriented species, whose every action is performed by groups or djans, each one with its own group mind, must cope with an individualistic, sight-oriented one that reminds it both of a fierce predator that it long ago extinguished and of a smaller primate that it equally long ago domesticated.

The members of a djan are digits, like the fingers of a hand, and they act as parts of the whole in much the same way. They have more independence, for they each have their own minds, but from time to time the djan group mind coalesces and reviews and realigns the individuals. Thus, when the group of all groups on the home world decides that humans are too much like that extinct predator and must be destroyed, the djan-mind on the bluebear ship can

order its digits to act accordingly, even though the individual digits are realizing that those back home don't really know what they are doing. Meanwhile the humans, too, have their problems of interaction and coping, and their computer has turned sentient, becoming a sort of djan-mind for them. Conflict seems both inevitable and inevitably disastrous.

The tale is thus one of individuality versus the group, and if Smith seems to favor the former, recognizing that the bluebear species does have members who act as individuals to the species' benefit, I don't give much away. But the tale is more as well, for Smith does a lovely job of realizing an alien mentality, and then of working out how humans and aliens might recognize their common interests and become something more than mere allies.

I commend it to your attention. And don't worry if you haven't read *Marathon*. *Rendezvous* may be a sequel, but it stands alone very well.

Speaking of sequels, I haven't seen a Dumarest in a long time, but here's number six in Asimov's Robot City series: **Perihelion**, by William F. Wu. Just to see where the series is going, and whether my prognostications of the overall plot were coming true, I read it, last night, which didn't take long, for the book is short and uncomplicated. The story amounted to little more than amnesiac hero Derec, now suffering as biochips build a microscopic Robot City in his body; his girlfriend Ariel, now recovering from an amnesia of her own; the Derec-built robot Mandelbrot (there's gotta be a fractal in here somewhere); the caninoid (sic) alien Wolruf (why do I expect her to have tusks?), and the ex-cyborg Jeff Leong running around in circles for 160 pages crying that they

haven't any idea of what is going on. Fortunately, the circles do converge on the secret hideaway of the mad, mad Dr. Avery, the genius behind Robot City, Derec's biochips, and Ariel's amnesia, and we learn Derec's true identity. But the series is not over yet. With one mystery settled, Derec can expect to be off on another quest in volume seven.

And what about my prognostications? Surprise! I seem to have been wrong. Derec is—or was, before the biochips got to him—quite human, and the aliens seem quite real. Thanks to those aliens, the series, though it has clear links to Asimov's future history, now violates the Master's vision in fundamental ways. It therefore loses much of the charm I expected to see in it. And without that charm of logical extension by other minds of a rigorously worked out background, it does not have enough charm of its own—complexity, originality, depth, what-have-you—to justify its existence. It becomes sloppy, trivial, trite, kid-stuff in the worst sense of that term, sci-fi not SF.

Maybe I'll check it out again around volume ten.

What do I need to say about Ray Bradbury's new collection, **The Toynbee Convactor**? That it's the first one since 1980? That it's full of warm and human tales, all of them told deftly and well, many of them with "gotcha" punch lines? That Bradbury remains America's premier stylist of sentimentality? That I enjoyed it?

Consider all those things said, and go forth and buy. Then for pure sentiment, you can try "The Laurel and Hardy Love Affair"; for funny "gotcha," "One for His Lordship, and One for the Road"; for scary "gotcha," "Trap-

door" or "The Thing at the Top of the Stairs." Enjoy.

The estate of the late Alice B. Sheldon has gifted us with one more collection of her potent short stories and novelettes—recent work, unpublished work, the best of her uncollected early work. The book, as by "James Tiptree, Jr.," is aptly titled **Crown of Stars**. Here is "Second Going," of the day when aliens drop in to visit and, incidentally, to show off their collection of genuine, in-the-flesh gods. Here are "Our Resident Djinn," of what happens when the devil hears of the death of God; the Swiftian "Morality Meat"; the long look at how youthful egocentricity and selfishness can spoil the bliss of age in "Backward, Turn Backward"; and more, ten in all. Some, such as "All This and Heaven Too," a satirical confrontation of ecotopian idealism and smoky, industrial reality, are weaker than others. All concern endings in one way or another, and they culminate very effectively in "In Midst of Life," which painfully foreshadowed her own depression and suicide.

Harlan Ellison's latest, **Angry Candy**, is a collection with an unusually potent theme. Each and every story, in one way or another, concerns death, and the book is unified by Harlan's realization that he had written too damned many obituaries in recent years. The introduction says as much as it lists a "necrology" of SF writers, editors, and artists—Tom Sheredd, Ted Sturgeon, Jack Gaughan, L. Ron Hubbard, Bob Mills, Frank Herbert, Judy-Lynn Del Rey, Manly Wade Wellman, Tom Scortia, Jorge Luis Borges, John D. MacDonald, Ted Cogswell, Dick Wilson, C. L. Moore, Terry Carr, Alice Sheldon, Alfie Bester—and friends, fans, and others, in-

cluding Richard Delap, Mike Hodel, Benny Goodman, Fred Astaire, and more, more, more. The list begins in April 1985 and stops in November 1987, before it could add Clifford Simak and Robert A. Heinlein.

Depressing, isn't it? Not to Harlan. Him, it makes mad, angry at being deprived of friends, angry at the world's loss of value, angry at the down-deep, bottom-of-the-hole unfairness of death. And *your* anger, he says, is the only real and true measure of how much you cared about the ones you have lost.

When he realized that this anger was

what unified the stories he had assembled for the book—from "Paladin of the Lost Hour" to the Gaughan-illustrated novella of soul-theft, "The Region Between," to the "Laugh Track" tickler, to "The Avenger of Death" and "Chained to the Fast Lane in the Red Queen's Race"—he wrote a seventeenth, "The Function of Dream Sleep," to make explicit the anger, the frustration, and the awareness that *your* memories of those you have lost are essential parts of their identities.

It's one of Ellison's best collections to date. Don't miss it.

ANADEMS

I had a letter the other day from Ann Hyde. Curator of Manuscripts at the Department of Special Collections of the Kenneth Spencer Research Library, University of Kansas Libraries, Lawrence, KS 66045. She closed the letter speaking as a reader, saying, "I appreciate the intelligence and trustworthiness of your column." And after such a stroke, how could I possibly refuse the reasonable, sensible, and entirely praiseworthy request she, speaking as a librarian, had just made of me? Which was to mention the Department of Special Collections's role as a repository of SF books, magazines, manuscripts, fan-

zines, authors' papers, criticism, and so on, not only for the use of scholars but also of the general public (described in the Spring 1988 issue of the newsletter *Books and Libraries at the University of Kansas*). She also commented that they would like to encourage donations of suitable materials, so if you "have or know of any material which a collector/writer/editor thinks is worth being saved, but not worth the space it's presently taking up, do remember us."

But write first. I have this sneaking suspicion that she would not appreciate seeing, at the library's loading dock, long queues of UPS trucks loaded with unwanted paperback collections. ■

● There is nothing particularly scientific about excessive caution. Science thrives on daring generalizations.

Lancelot Hogben, 1938

(Submitted by G. Harry Stine)

THE ENGINEER DISCOURSES UPON HIS LOVE

Michael F. Flynn

*He lifted high his glass and sipped
A swallow, worked his throat and dipped
His shaggy head upon his breast.
"Pest." said he. "I don't know how I take it.
But love it is. I could not feign nor fake it."
He threw his arms apart and he confessed:*

Were I to name what charms me, I suppose
That it would be her Angle of Repose.
It lures me with Reciprocating Motion,
With Piston Stroke, Compression, and Explosion.
This notion, I confess, doth quell all others,
Despite our arguments and fights and bothers.

Alas! Is Friction's Coefficient far too high
And generates Waste Heat 'tween she and I
So sigh we for lost Equilibrium;
Before dread Entropy we are undone.
Once content we were in other circumstances.
But now I fear we're out of Tolerances.

Still do I feel the greatest Sheer and Stress
Whene'er it is that I do see 'er undress.
I confess I love this lure of Eros' prison,
Held in place by Supermagnetism.
Wishing it weren't so won't quell my fever.
Because, you see, I simply Cantilever.

brass tacks

Dear Dr Schmidt:

- . . . About all-year use of public schools.
1. Do the *buildings* need a long, long summer rest every year? If so, why do school buildings, which are notoriously underutilized even during the school year, need more "rest" than public buildings such as police stations, court houses, bus depots?
 2. Do the teachers really need a three-month vacation each and every year? What other learned occupation gives people a six-hour day and a nine-month year, but supposedly pays for an eight-hour day and a twelve-month year?
 3. Can the self-learning experiences that you refer to only occur during summer? If so, is *that* the explanation for the difference between tropical countries and temperate-zone countries? Only the temperate zone has a distinguishable summer, and that's the only time that children can have the good experiences that you did? An interesting notion, but not believable.
 4. Is it really true that everyone in the adult world takes a summer vacation nowadays? I'd like to see some studies on that.
 5. Isn't the summer vacation a holdover from agricultural days, when the kids went to work in the fields out of dire necessity, but no such labor was needed during the winter? The janitors and teachers likewise went to farm work (more lately, food-processing work, in rural areas) at the same time. But does this apply to the largely urban/suburban population of today?
 6. What good reason is there, then, for building more and more schools, occupying more and more ground per school as so-called "national standards" keep growing, when the buildings are used less and less?

CHAS. H. W. TALBOT

Seattle, WA

1. *Are schools operated primarily for the benefit of the buildings—or of the students who are supposed to be educated in them?*
2. *Yes, many teachers need that vacation. Optional summer schools already exist to employ those who don't. (Which also, incidentally, keeps the buildings from being empty as much as you claim.)*
3. *No, the vacation does not have to be in the summer. But it does have to be a vacation.*
4. *No. So what?*
5. *Yes, it did originate for the agricultural reasons you name, and those are less widely applicable now. None of which has anything to do with the fact that the summer vacation turns out to have other values which we can now afford to take advantage of.*
6. *See above.*

Dear Dr. Schmidt;

I was pleased and impressed with your editorial in the July *Analog* on year-round schools ("A Requiem for Summer?"). I am always pleased to hear the voice of reason.

But you missed that part of the picture, which sooner or later will permit the institution of year-round schools. Of course I mean the working mom. More than one mother of my acquaintance has wrung her hands and sighed for a nice, simple *one-location*-facility for her kids, with continuity of both supervision and companions. Vacations for her and for them are a mad scramble, a never-ending attempt to set up alternate daycare. Even then, there are far too many latch-key children left alone at far too early an age, to suit many professionals.

I am a stay-home mom. *If* my husband was not a miser, and *if* our house was not an economical condo, and *if* either of us was susceptible to our culture's current fascination with material goods as the best—nay, the *only*—rec-

ognizable form of status . . . then our life-style would be at severe risk. As it is, we have so far survived, though every penny gets squeezed twice: "You a nickel yet?" "Nah!" Malevolent grin from coin.

Once I worked downtown, carried a briefcase, and wore blue suits. I hated it, especially working three jobs—mom, housecleaner, and secretary. Finally, I *put my foot down*. Either my beloved would stay home and be the caretaker parent, or he would let me do it. After counseling, he agreed, but he wanted to be sure we could afford it. And, surprise, it turned out that with care, we could.

Now these moms out there who think they *have* to work may well be right—for them. But what their kids would miss by year-round school, they really miss already. Not for them the unstructured time of ambling down railroad tracks, or down the block to see if a buddy is home and maybe wants to fly a kite. Even these kids' "free" time is structured, with the lessons and organized sports these moms work so many hours to buy.

You mention the "restorative value" of vacation time. This is precisely the freedom possible only *when there is a secure base to come home to*. Without an available and accessible parent, even teenagers find themselves at a loss.

The recurring chant of childhood is, "Look, Mom!" What good is it to catch a frog, when there's no one at home to show it to?

MELANIE MANDEVILLE-RODDEN
Arvada, CO

Dear Stan,

I began reading the August *Analog* this morning and eventually came to the book reviews. To my chagrin. In his review, Tom Easton savaged my recent novel, *The General's President*, so severely that it may have harmed its mar-

ket performance and my own reputation. One could say that's a risk of the game. Nonetheless, I'm sending you a few reviews which suggest that *The General's President* is in fact a very good novel. Perhaps you'll excerpt a few comments from them in your editorial response to this letter.

Tom isn't the kind of reviewer who plays nasty little games. Perhaps the novel pushed some button or violated a taboo. I assume he has some; just about everyone does.

I am not a political critter, but I sometimes do watch C-SPAN (the politics channel) at breakfast, and became aware that my own political views tended to be ambiguous and often inconsistent. So I decided to explore political ideas in a novel. SF writers are given to exploring ideas of many kinds in stories. At the time I was working on another book, but I took time to do a lot of preparatory reading, not only on American government but briefing books on world trouble spots; Soviet government; the Soviet army and Soviet intelligence services; the American military establishment; the White House domestic staff; the Secret Service; current military technology; vulcanism and plate tectonics; etc. I discussed law reform with an attorney; economics with a doctoral candidate in economics; Soviet government with a professor of Soviet government. (The preparation was half the fun.) Finally, I undertook to write a novel set in an extreme situation, and to play with the material and ideas in what I consider a thoughtful and stimulating way. In the writing, I was often surprised at what came out, but there's nothing unusual in that. Tom erred by 180° in describing me as a frustrated ideologue.

More central to the story than its politics are the character of the non-political president and the thesis that the

introduction of truly major new technology has the potential to invigorate American economics. Also central is the strange little war that grew out of the same breakthrough. There was no suggestion that a utopia resulted, only a reprieve and a fresh start.

Perhaps the characteristic of *The General's President* that makes it unusual, as political SF, is its lack of indignation and anger. Its president is not a zealot, he enjoys very good emotional stability, and he is tolerant. (The latter two often go together.) And the book seems to have worked well. I've gotten more letters from readers pleased with it than I have for any other of my twelve novels. (And phone calls! On the acknowledgment page I mentioned the town I live in, and I have a listed phone. I'd never before received phone calls from strangers regarding a book of mine.)

Nuf said. Tom had his at-bats. This is mine, if you print it.

JOHN DALMAS

Mr. Easton replies. . . .

Dear John:

Are you an ideologue because you have something to say? No. Nor because we disagree, because, as I said in the review, we don't. Are you frustrated because nobody pays attention to you when you say it? You say no, so I obviously overinterpreted on that one.

But my main critical point was not that you were an ideologue or frustrated. It was that *The General's President* was much, much too heavy on the preaching. And now you tell me that it was deliberately so.

In that case, it was a distinct success.

TOM EASTON

And finally, Mr. Dalmás again. . . .

I admit to having had a lot of fun developing and rolling out political and governmental ideas while writing *The General's President*.

Analog Science Fiction/Science Fact

No sermon was intended. In spite of this, Gustafson, in "The Serpent's Tooth," felt "that Dalmas is espousing his personal philosophies." This didn't seem to bother him though; he rated the story "highly recommended." The *Chicago Sun Times* wrote that it contains a "well-preached sermon, with an original and intelligent concept," then went on to praise the prose, the characterization, etc. *Publisher's Weekly* called it "a sweeping and clever attack on. . . ." That really surprised me! I'm not into attacking. Another wrote that *Pres* would be "starting arguments for years to come," and here we have one of them. But I hadn't expected this particular argument.

JOHN DALMAS

Dear Stan:

G. Harry Stine needs to be more precise in his language in the August issue's "Alternate View" column (and you need to watch what goes on the contents page and not give credit to John G. Cramer for Stine's column).

"When the Huns and the Turks and the Mongols failed to conquer the Orient . . ." Wrong—the Mongols did conquer both India and China. The Chinese emperor, Kublai Khan was Genghis Khan's son, and the Moghul (Mongol) Dynasty in India survived until the arrival of the British and French. What Stine presumably meant to say was that the Mongols, though in power for roughly 100 years in China, didn't keep control long enough to wipe out memories of former Chinese institutions, and when the rulers were overthrown, the Chinese returned to a government similar to the one they'd had before the invasion. The Mongols also conquered the so-called "Near East," and their descendants are still there—but they converted to Islam along

the way. The only part of the Orient they didn't conquer was Japan.

R. COULSON

Hartford City, IN

Dear Stanley:

The polemics about Easton's review: "biggest con game in history"; "security"; "maximum freedom"; "equally evil or good"; "free society"; and co. show unreality as rampant as ever. The writers ignore the lessons of history. Examples:

All governments are by nature treacherous, perfidious, and ungrateful. No matter what promises a leader makes, he can always repudiate them, citing *salus populi suprema lex*. Even if a leader wants to keep his word, his successors may not. Examples are countless: in America, flooding the Seneca reservation after promising not to as long as the grass grew; the Indian government's cutting off the pensions promised the rajas; the Soviet Union's imposing Communist governments on Poland and co. But for the results of no government, see Lebanon.

Most people, most of the time, are mainly motivated by self-interest. This is primarily insuring the individual's survival, and the survival of those close to him. Survival assured, self-interest becomes the quest for wealth, power, and glory. Hard-core altruism is normally limited to one's family and close friends; religions and philosophies try to make people extend altruism to others of their tribe, sect, nation, or species. None has completely succeeded.

According to the Gospels and Acts, Christianity started as a reformed Judaism on communistic, pacifistic principles. The present Communist movement may be called an unsuccessful attempt to put the ideals of Christianity on a scientific basis. As happens

with such movements, as soon as it begins to succeed, self-seeking men elbow out the idealists and run the show for their own profit.

"National security" became obsolete with Hiroshima. No nation can be secure in the old sense when another's leader can wipe it out by pushing a button. The button-pusher may perish from retaliation or from nuclear winter, but a loony like Hitler might chance it. Now the best defense is a high-powered diplomatic corps. Reagan's administration has impaired this "first line of defense" by setting a record for appointing unqualified political and financial backers to diplomatic posts.

No foolproof method has been found for choosing leaders. Hereditary monarchy, if it occasionally produces a hero-king like Albert of Belgium, more often produces a Charles the Simple, Pedro the Cruel, or Selim the Sot. A leader chosen by the executive committee of a one-party state may turn out to be a Stalin, who killed more people than Hitler. Popular election can pick a Churchill or a Lincoln, but also a Hitler. Its one advantage was stated by Machiavelli in *I Discorsi*: Princes and republics make the same kinds of mistakes, but princes make them more often, because nobody dares to tell them when they are wrong.

A "free society" with "maximum freedom for the individual" sounds fine; but any value taken as an absolute conflicts with other values. Take liberty and equality. You can have neither, as in monarchical France; but when you try to increase both, you find that eventually one can be expanded only at the expense of the other. If everyone has unlimited liberty, some, being smarter, more energetic, and luckier than others, will dominate and exploit the rest. Among the blessings given to us by American

liberty are a homicide rate 70-odd times that of the average of western Europe and Japan.

So let's try to assure equality. But then we need an equality police to assure everyone the same rewards. Then the equality police become the new ruling class, who oppress and exploit the rest as ruling classes normally do.

About Russian intentions of "dominating the world": believing they have a superior system, their leaders want to convert the rest of us so that all shall enjoy its benefits. Likewise the Pope hopes for an all-Catholic world. But at least the Catholic Church has given up burning dissenters at the stake; so perhaps the abolition of the Gulag is not too much to hope for some day. And the United States has millions who think America has a God-given duty to impose its peculiar form of capitalist democracy on other nations whether they want it or not.

L. SPRAGUE DE CAMP

Dear Dr. Schmidt:

I've had enough!

Our space program is in complete disarray, we have no coherent purpose, we have no long-range goals, and we lag far behind the Soviets. The Europeans, Chinese, Japanese and Indians do not suffer from our malaise, and are slowly proceeding in the Russian's footsteps to the stars!

Recent Brass Tacks letters advocate letter-writing campaigns to our politicians to inform them of our desires for a strong national space program. People suggest that we should inundate Washington with a blizzard of paper!

Like many *Analog* readers, I've been writing letters to senators and representatives advocating a strong U.S. Space Program for over ten years. I get back

very nice replies acknowledging my concerns, but when the votes are taken, the story is clear. Letter writing alone will not accomplish in the future what it has failed to accomplish in the past.

What our elected representatives understand is MONEY. It's time to hit these jokers in the pocketbook. As Gus Grissom is quoted in *The Right Stuff*: "No bucks, no Buck Rogers." It's time to make this sentiment work for us!

One of the most effective ways of getting the politician's attention is by way of the Political Action Committee (PAC). These highly organized groups have been extraordinarily successful in promoting their own political views, and protecting the rights of their members. I give as an example the National Rifle Organization (NRA).

I'm tired of being patronized by the politicians. I'm tired of watching the Russians and all of their many successes. I want our country to be in space, and I want us to go to stay!

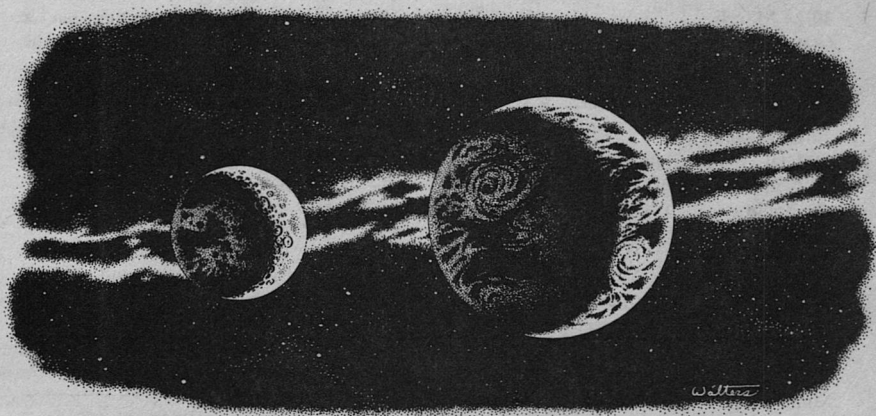
To this end, and for the above reasons, I have formed SPACEPAC. SPACEPAC is a nonprofit Political Action Committee dedicated to achieving the goal of a strong, vital, national Space Program, with a permanent U.S. presence in space.

I urge readers, who feel as I do, to join SPACEPAC. Annual membership costs \$40.00, but all donations are appreciated. Our mailing address is SPACEPAC, P.O. Box 611, Penn Yan, NY 14527.

Let's go to space together!

ARTHUR J. AHRENS

Penn Yan, NY



a calendar of
analog
upcoming events

10-12 March

LUNACON '89 (New York City area SF conference) at the Westchester Marriott, Tarrytown, N.Y. Guest of Honor—Roger Zelazny, Artist Guest of Honor—Ron Walotsky, Fan Guest of Honor—David Kyle, Guest Editor—David Hartwell. Registration—\$20 until 20 February, more at the door. Info: Lunacon '89, Box 338, New York NY 10150-0338. Include S.A.S.E.

15-19 March

Tenth Anniversary Conference on the Fantastic in the Arts (academic SF conference) at Ft. Lauderdale Airport Hilton, Dania, Fla. Guest of Honor—Doris Lessing. Registration—\$60 (IAFA members), \$70 (non-members), \$40 (student), \$80 (on-site registration), \$25/day (on-site). Info: Donald Palumbo, Treasurer, English Dept., Shippensburg University, Shippensburg PA 7257.

20-24 March

General meeting of the American Physical Society at St. Louis, Mo. Info: A.P.S., 335 East 45th Street, New York, NY 10017.

24-26 March

BALTICON 23 (Baltimore area SF conference) at Omni Hotel, Baltimore, Md. Guest of Honor—C.J. Cherryh, Art Guest of Honor—Stephen Hickman, Fan Guest of Honor—Steve Stiles. Registration—\$20 until 28 February, \$30 at the door. Info: Balticon 23, Box 686, Baltimore MD 21203.

24-26 Minnicon 24

(Minnesota SF conference) at Minneapolis, Minn. Guests of Honor—Harry Harrison, Fritz Leiber, George Laskowski, Freeman

Dyson. Info: Minn-STF, Box 8297, Lake Street Station, Minneapolis, MN 55408.

24-27 March

CONTRIVANCE (British National SF Convention) at Hotel de France, St. Helier, Jersey, C.I. Guests of Honour—Anne McCaffrey, M. John Harrison. Registration—£15 attending, £8 supporting, £6 child or associate, £1 child under nine. Cheques payable to Contrivance; payments in US\$ at rate of \$2 = £1. Info: Contrivance, 63 Drake Road, Chessington, Surrey KT9 1LQ, England, U.K. U.S. Agents—Bill & Mary Burns, 23 Kensington Court, Hempstead NY 11550. Scandinavian agents—Mats Claesson, % Bjork, Saltamang 12, 11359 Stockholm, SWEDEN

31 March-2 April

ST. LOUIS FANTASY FAIR (media oriented SF conference) at Breckenridge Frontenac Hotel, St. Louis, Mo. Confirmed guests—John Levene and Janet Fielding. Registration—\$35 until 15 February, \$40 thereafter. Friday only \$10, Saturday only \$20, Sunday only \$15. Info: St. Louis Fantasy Fair, Box 4302, Chesterfield MO 63006-4302.

31 August-4 September 1989

NOREASCON III (47th World Science Fiction Convention) at Sheraton-Boston Hotel & Hynes Convention Center, Boston, Mass. Guests of Honor—Andre Norton, Ian & Betty Ballantine; Fan Guest of Honor—The Stranger Club (Boston's first SF club). Registration—\$70 (adult), \$45 (child), to 15 March 1989; \$80 (adult), \$50 (child) to 15 July 1989. Supporting—\$20 at all times. No advance memberships after 15 July 1989. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition, the works. Join now and get to nominate and vote for the Hugo awards and the John W. Campbell Award for Best New Writer. Info: Noreascon III, Box 46, MIT Branch, Cambridge MA 02139.

—Anthony Lewis

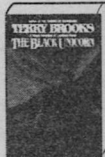
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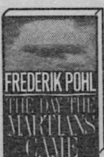
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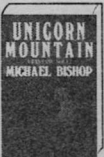
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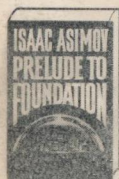
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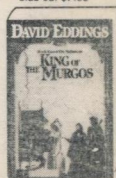
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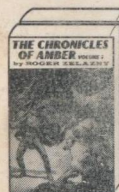
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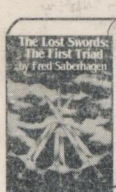
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