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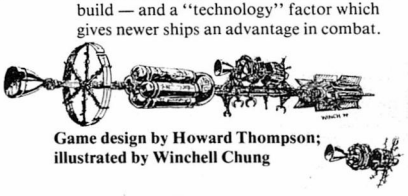

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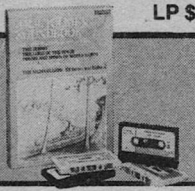

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Guest Editorial by Richard Rosa

experimentalism

We need a new 'ism.

"Like a hole in the head!" you may reply, recalling the appalling number of heads holed in the name of old 'isms.

But we cannot get along without some beliefs, and at the moment we don't have many. Without a set of beliefs, i.e., an 'ism, we simply drift aimlessly, and this is pretty much what we and our ship of state are doing now. The old belief systems like capitalism, socialism, and communism have long since lost whatever crisp clarity of content they may once have had. No government in the world today conforms to any 'ism that the founders of those 'isms would recognize. All are mixtures in various degree. We hear the Russian government called "state capitalism." We hear our own called "creeping socialism." We praise or condemn one or the other without really knowing to what we are referring.

Eventually and inevitably, all 'isms are fated to lose their original meaning just as all words, however subtly, change their meaning as the language of which they are a part evolves. Language is plastic. A healthy society is plastic also and so if for no other reason must adopt new 'isms from time to time.

The 'ism that I propose for adoption now is "experimentalism." In this technological age, one might expect that the implications of such a term would be reasonably clear to everyone. However, there is abundant evidence that they are not clear even to most professional technologists. I propose, therefore, to describe the implications of the term, first for science and technology where they are most clear, and then for the larger world in which we all live.

The last few generations have witnessed the total triumph of science. Why? Because the scientific method has been employed—a method maligned, misunderstood, misapplied, not even employed by most individual scientists, but employed infallibly by the scientific community as a whole, and with infallible results. Indeed, the scientific method is infallible by definition. Let us define it.

The scientific method can be defined as the following procedure: first, an experiment is performed or an event in nature is observed closely. Data are collected. Second, a theory is formulated to explain the data and,

what is most important, to predict what the results will be if the experiment is performed or the event observed a second time under the same or other specified conditions. Third, the second experiment or the second observation is carried out. Fourth, theory and experiment are compared. If the comparison is poor, one starts all over again, back to the drawing board. If the comparison is good, one publishes a paper and chalks up one more for science. Success, somewhere, somehow, some time, is assured. Knowledge increases; "knowledge" being perhaps best defined as the ability to predict successfully the results of the next experiment.

Now you may feel that this is all very fine but that there are a lot of important questions that science can't answer. The scientist replies that there are merely questions that science shouldn't ask. Indeed, knowing what questions *not* to ask is an important part of scientific knowledge. Scientists have learned not to ask simultaneously for the precise position and velocity of an electron, or what came before the beginning of time, or what lies beyond the edge of the universe, or any question not answerable, at least in principle, by an experiment. Science has come to recognize that there are some questions that have no answers or, at best, merely probabilistic ones.

Even to answerable questions, a scientist will seldom give a firm answer. The average number of qualifiers used per sentence must be significantly higher in the speech of a scientist than in the speech of anyone else. The scientist is not being evasive; he is merely being objective about what lies beyond the realm of science at the present time. He has faith that the realm of science will expand as time goes on, but never encompass all knowledge. He would be disappointed (and unemployed) if it did.

The scientist knows that at any given moment in time his knowledge is incomplete—or perhaps wrong. He believes in a theory only to the extent that it agrees with experiment and fully expects that today's triumphant theory will be supplemented or supplanted by another theory tomorrow. Above all else, the scientific enterprise succeeds because the scientist never presumes to knowledge that he does not possess. (I should make it clear that I am using the label "the scientist" in a normative sense to describe the aggregate effect of the behavior of all scientists, not the behavior of any individual—a perhaps obvious distinction, but important, as we will see.)

The success of the scientific method in the hard sciences has led to its application in the soft sciences such as sociology and psychology. These sciences are much more complex and it is much more difficult to control or define the conditions surrounding an experiment. Therefore, progress, in comparison to progress in the hard sciences, has been slow, although there has been progress. But now what about the still softer sciences, the

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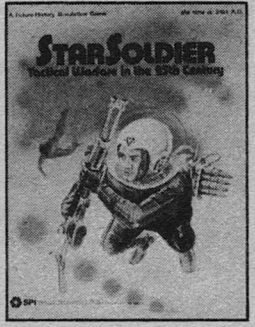

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softest of all, and the most important—political science, government, and economics? Can the scientific method be applied to these? Has it been? Correctly? Successfully?

My answer to these questions is that the scientific method can indeed be applied to these softest of sciences and that it ostensibly has been applied, but not correctly nor has it been successful. The philosophical and practical implications of the scientific method have been mislaid or misunderstood.

Today, what often passes for the scientific method in government is the following: If a congressman, a cabinet member, or a federal bureau chief decides that he needs advice in an area touched upon by one of the sciences, hard or soft, he calls in an "expert"—a physicist, an economist, an engineer, or whoever else seems appropriate. Better yet, he calls in several. He asks them for an answer to his question. If they are honest—and like the population at large, not all, but most are honest—they must usually reply that they cannot give him an answer but only an opinion.

If this is not good enough, the congressman, cabinet member, or bureau chief will commission a "study." That is to say, the expert or panel of experts will be given a month or several to ponder the question and perhaps poll other members of their profession. Let us suppose a poll is taken and, for simplicity, let us suppose that the question is one that can be answered by a yes or no. Furthermore, let us suppose that the results of the poll turn out to be 51% yes and 49% no.

Now a scientist who performed an experiment one hundred times, getting one result fifty-one times and another forty-nine times, would conclude that the question had not been properly posed or that his experiment was inadequate or that either result was equally probable—like flipping a well-balanced coin.

The politician, however, lives in a different sort of world, a world in which 51% is as good as 100%. Fifty-one percent or even 50.1% of the votes of the folks back home sends him to Washington and sends his opponent to oblivion. It happens all the time.

Therefore! When the results of the study are reported to him, couched, no doubt, in careful phrases containing copious qualifications and dignified by encapsulation in a volume of several hundred pages plus supplementary volumes full of computer printouts, he, being a busy man, looks to the bottom line, solemnly announces that the consensus of the experts is "yes," proceeds to decide accordingly, and so, by what essentially amounts to the flip of a coin, yet another decision affecting us all is made.

The experts are getting a bad name, and it's no wonder. But the real tragedy is the bad name given to the scientific method. The scientific method is after all merely a prescription for learning from experience. We abandon it at our peril.

A contributing problem is that even

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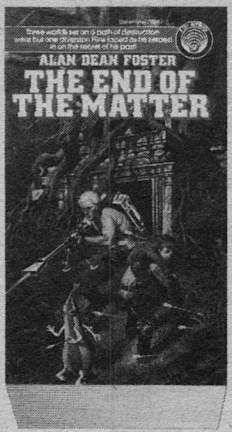

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the individual scientist does not practice the scientific method in his own work, at least not with much consistency. He has passions, drives, needs, and desires just like anyone else. He wants *his* theory to be accepted. He wants *his* machine to be constructed. He *needs* to have his grant renewed next year. Moreover, science, like art, is often advanced by individual acts of intuition, by logical reasoning so intimately mixed with guesswork that it is hard to tell until long afterwards which was which. It is not surprising then that even the scientist is slow to see how misunderstood and misused his own methods are when applied to government and economics.

In view of what has just been said, it is necessary—and instructive—to ask again how it is that science, the sum total of the work of all scientists, itself manages to succeed. Two reasons seem evident. The first is a strong tradition of constant communication between scientists. Indeed, the nature of the scientific enterprise is such that the result of an individual's work is of no value either to himself or to anyone else until it has been communicated to others. Scientists are constantly going to symposia, giving seminars, reading and writing papers. The battle cry of the profession is, "Publish or perish!" A scientist who could not communicate with his fellows would soon be out of date. This is less true in the applied sciences and engineering where the work may be classified for ostensible military reasons or where it may seem advantageous to temporarily keep one's result secret until it appears in a product on the market. Secrets are seldom kept for long, however. It's futile. Scientific knowledge is so universally shared throughout the industrial world that if the time is ripe for a discovery, then within a period of a few years or less, the discovery will probably be made in several places.

The constant cross talk insures that new knowledge spreads rapidly and false knowledge, not withstanding a few bizarre historical exceptions, is soon exposed.

The second and ultimate reason for the success of science is the absolute dependence upon experiment. Not even Einstein was believed except as his theories explained the results of prior experiments and predicted the results of new ones. Still today, seventy-odd years after they were first promulgated, Einstein's theories are still being tested, tested, and tested again against experiment. Acceptance of a theory results only when numerous experiments done by numerous individuals in numerous places all produce the same result. Even then, it is provisional and there usually remain a few caveats and conditions—the velocity must not exceed x percent of the speed of light, the pressure must not exceed y atmospheres.

So it is that even though the individual scientist may not at all rigorously follow the procedure of experiment-theory-experiment, the scientific community sees to it that the procedure is followed.

This was not always so. There have been times and places in the past when science, or more generally, the pursuit of knowledge, was not based upon experiment. Throughout history, there have been men who believed and philosophies which taught that the human mind could construct a coherent image of the real world without recourse to experiment, who believed that pure thought and logical argument could uncover the truth up to and including the ultimate truth that is the province of religion.

Greek thought was based upon observation and experiment, but Roman thought was not. Stoic, Epicurean, and neo-Platonic philosophies held that nature was a finite thing, completely knowable by the exercise of logic and rhetorical argument. Man and the Universe, microcosm and macrocosm, were said to be reflections of each other. Ultimately these ideas were absorbed into the early Christian church and dominated the thought of the Western world throughout the Middle Ages. "Through St. Augustine, above all men, early Christianity acquired its distaste for a consideration of phenomena. 'Go not out of doors, ... Return into thyself. In the inner man dwells truth.' For a thousand years men responsible for the thought of the Western World did not go out of doors."[1] Scientist and non-scientist call this period the Dark Ages.

"With the fifteenth century discontent with the entire medieval scientific scheme becomes more generally obvious. The idea that it may be possible to adjust theory by experiment again comes to the fore."[2]

In the early sixteenth century, led by Copernicus, Tycho Brahe, and others, men went out of doors again and began again to observe the universe and to experiment. From then on, science progressed with increasing rapidity up to the present time.

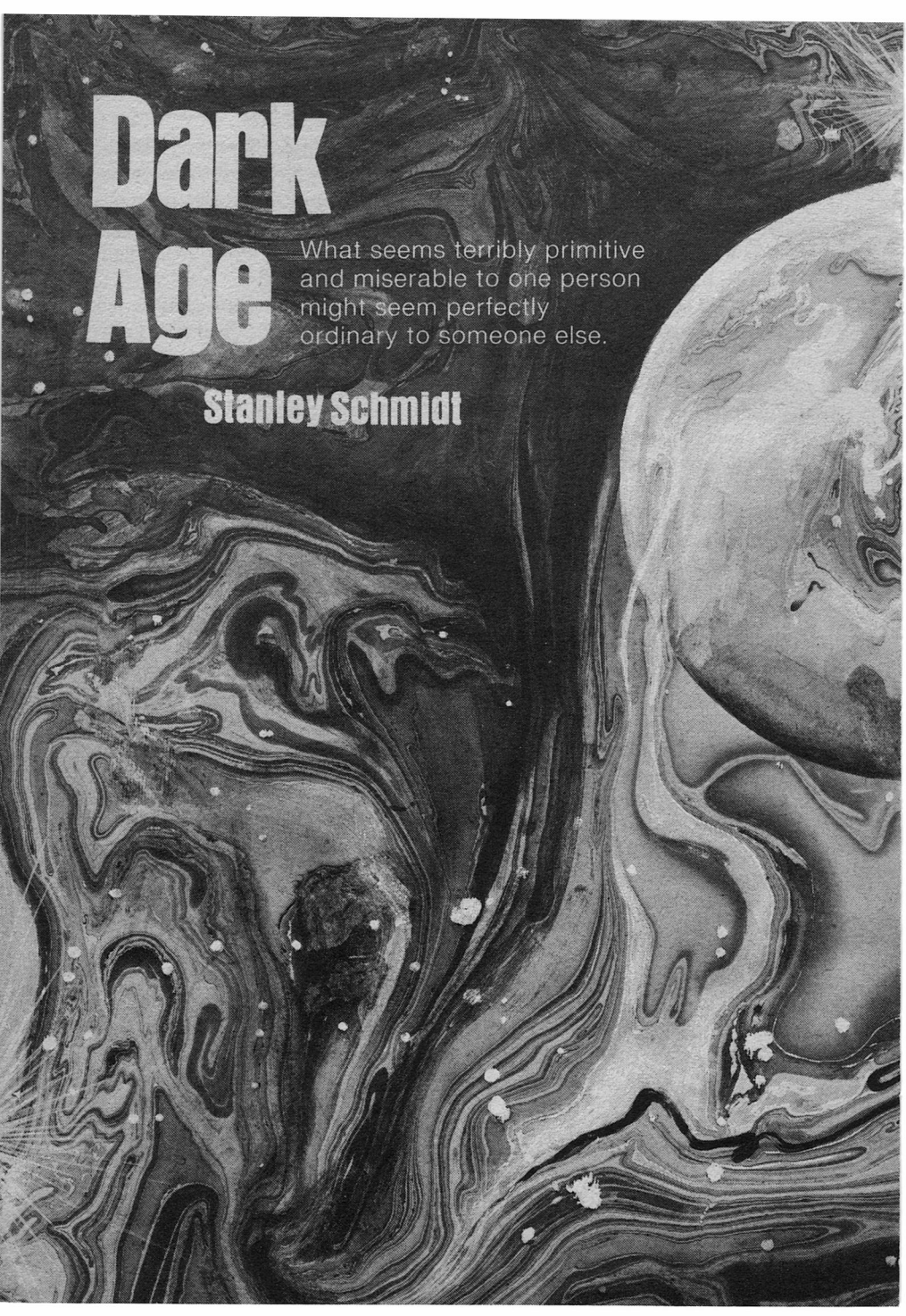
The essence of the story of science is that the mind of man by itself produces nothing of scientific value, that is to say, no knowledge about the world we live in. The great theoretical minds, those of Newton, Maxwell, and Einstein, tend to capture the popular imagination, *but it must be kept clearly in mind that what they were all doing was describing and explaining the results of experiments.* It has been said that the mind is but the servant of the hand. That's perhaps an overstatement, but without doubt, each is crippled without the other. In science it has been typical for a great body of data to be accumulated over a period of years or even centuries before a theoretical synthesis unifying the diverse data has been possible.

These comments are in no way a reflection upon the power of the human mind, which is magnificent. The human mind can and, in cosmology and mathematics, for example, often

continued on p. 160

[1] *C. Singer,* A Short History of Science, *Oxford University Press, 1941, pp. 124-125.*

[2] *C. Singer, op cit, p. 170.*


Dark Age
What seems terribly primitive and miserable to one person might seem perfectly ordinary to someone else.
Stanley Schmidt


mike Kinge

It was dark all over by then. Even the south pole star (which once had been the Sun) had faded into the same league as its myriad fellows; Sirius and Canopus actually outshone it. No point on Earth had any sky but a black and starry one.

But the real dark age—the time that would make this one seem ablaze with light—was yet to come. Soon.

If it was allowed to.

There were those, as the twenty-year plan neared its culmination, who feared that it wouldn't.

And there were those who feared that it would.

"Please, no names." The other man in the small, nearly bare room interrupted with a peculiar smile. "Ideally," he said, "we shouldn't even know each other's names. I do know yours, of course, but the circumstances are unusual. We mustn't use it here, or anywhere that we meet in the Cause. The walls, alas, have ears—and they're growing new ones all the time. So . . . here, you are Brad, and only Brad. And she, if you must mention her, is Rosanne. Do you understand what I'm saying?"

"Brad" nodded slightly. "I understand," he said coolly. "Brad. Rosanne. And you . . . ?"

"I am Moses."

Brad glanced at him with double surprise, but he didn't let it show. The slightly-built, early-thirtyish man on the other side of the table, with his hollow cheeks and thinning, dishwater-blonde hair, was a far cry from the heroic image his radio voice evoked in his comnet listeners' minds. But people never look like their broadcast voices, and what he looked like was immaterial. The voice was right, and what mattered was the ideas he stood for. Brad accepted the fact that this was Moses.

The other source of his surprise was harder to dismiss. "I didn't expect to meet you personally," he remarked. "I thought you didn't let yourself be seen." When Moses said nothing, he added awkwardly, "Do you live in Titusville?"

Amusement flickered across Moses' otherwise placid face. "Where I live," he said, "is one thing I never discuss. Let's just say I'm a good deal more mobile than most people these days. If I weren't, I couldn't have lasted this long. You'll never see me in this room again." He looked hard at Brad. "And you're quite right that I normally don't let myself be seen. But, as we already agreed, circumstances are unusual. Normally we'd be reluctant to use somebody as young as you, or as new to the Movement, for such a delicate and critical assignment. But time's running out. We may not have much choice."

"Should I feel honored?" Brad asked wryly.

"I don't particularly care how you feel. All I care about is how you perform. We've been checking up on you; you come well recommended. But in this one case I thought I'd better talk to you personally, in spite of the risk. Partly to look you over for

myself, and partly to impress upon you the extreme importance of what we're asking you to do." He chuckled harshly. "Don't think I've done it without thorough precautions. Remember that if you get any ill-advised second thoughts."

Such talk in itself could at least suggest second thoughts. But Brad only asked, "Exactly what are you asking me to do?"

"Ah." Moses smiled a smile of uncertain meaning. "Very well, Brad, we come to the meat of the matter." He lifted his gaze, focusing somewhere above and behind Brad's left shoulder. "As you well know, in just a few days the Kyyra will begin raising the Earth's acceleration again, this time farther and faster than ever before. The *sine qua non* of our program is to make sure that doesn't happen. Because if the buildup is allowed to begin, there's no way we can prevent the miseries that come with it and establish the alternative order."

Brad nodded but said nothing.

"We've been working on many fronts, but what we'd prefer to do is persuade Henry Clark to call the whole thing off. Unfortunately, Clark is a very stubborn man."

Brad smiled thinly. "I know." Everybody did.

Moses did not smile. "We've already applied a good deal of pressure to him, but it hasn't been enough. With the deadline so close, we're going to have to push harder. Much harder."

"Meaning how much force?"

Moses told him what he had in mind. And for the first time, Brad's reaction was too strong and too automatic to hide. "Is that necessary?"

Moses' eyes narrowed. "Yes," he said sharply, "and you can't afford that kind of doubt while you're doing it. Get rid of it." His voice softened a little, but only a little. "You question the necessity. Think about it. Under Clark we've had the work draft, the contraceptive restrictions, Matchmaker. You haven't been affected much by those—"

"Not personally. But I have a brother."

"Indeed. So you've seen something of what tyranny can be. If things go on as they have, you'll see more. You were lucky enough to find a wife for yourself before Matchmaker got you—"

Brad frowned. "How do you know that?"

"Come, Brad. I told you we checked up on you. Such matters are among the first and most basic that we check. But that's beside the point. The point is that you were lucky. You found her. You have each other, and you both want to keep what you have. Right?"

Brad hesitated slightly, not because it wasn't true, but because it seemed nobody's business but his and . . . "Rosanne's." But he didn't hesitate long. "Right."

"Well, I might point out that while you escaped Matchmaker, you still have the other things to look forward

to. How big a family do you want? Caesar Clark will see that you have as little choice as possible. Will you be there to enjoy it? It depends. The work draft can still get you. I don't think I need to be too graphic about that."

"No," Brad agreed, thinking of his brother and several friends.

Moses's voice grew intense, picking up the fervent intonations, even some of the words, of his radio speeches. "It doesn't have to be that way. Clark has justified his totalitarianism by a state of emergency. Despots always do. But the emergency doesn't have to go on. The promised land, for us, is not in some alien jungle in M31, years in the future. It's here, now. Life isn't so bad anymore, except politically. If we abandon the high acceleration plan, Clark has no justification for continuing his dictatorial measures. Get rid of them, concentrate on improving living conditions, and we can build something truly worth keeping. Here, now. Maybe we can get rid of Clark. Maybe, in time, we can even reinvent democracy."

Brad carefully suppressed emotional reaction. "You want me to be completely convinced? Then let me play devil's advocate for a minute. Your program sounds fine—except that if we adopt it, we'll never see the new world. We won't get there in our lifetimes. The whole point of the twenty-year plan was that by enduring hardships for a while, we could."

"But is it worth it? The new world has been over-advertised, Brad. Life isn't going to be easy for the settlers who have to tame it. Who wants it so badly, anyway? People who are nostalgic for the Earth they lost. People like you and me don't have that handicap. We never saw Old Earth, or at most we saw too little of it to matter. Why should we miss it?"

Brad sat silent for several seconds. Finally he said slowly, "Maybe we shouldn't. But I'm not sure. Maybe it hasn't been as oversold as you say. If we never saw Old Earth, how can we know?"

Moses' nostrils flared slightly and he forced a thin, distantly ominous smile. "Well, Brad, maybe we don't *know*. But I suggest that you think very carefully about how much of what you *have* you're willing to gamble away betting that a fairy tale is true. Meanwhile . . . where do you stand? We need your help now. We've already taken the first step. Are you with us?"

Brad stood up. "Maybe," he said. "I need to think it over."

"We need your answer now."

"Even if it's no? You also need me, or so you say. Well, then, you can wait till I'm ready to commit myself." He turned toward the door, but not too fast to see Moses' thinly veiled anger.

"There's not much time," Moses said tightly. "Here . . . take this with you, so we can keep in touch, at least. It may be crucial."

Brad turned back around. Moses was holding a small metal cyclinder out to him. It looked like an ordinary pocket communicator, but Brad

stared at it for quite a while before he took it. And he turned it over in his hands, looking some more, before he put it in his pocket.

"We'll call you if we need you," said Moses. "Meanwhile, remember what I said about precautions. Now that you've seen me, you can't just fade away. But I hope it won't come to that. I hope you'll see that the Cause really needs you—and deserves your help."

Sandy and Jonel Turabian went to Henry Clark's office-apartment as soon as he called them. What he had to discuss *might* not be urgent, he had said—but on the other hand it might. He didn't want to take chances, and neither did they. There was too much at stake.

Clark looked up as they came in, but he remained seated behind the desk. He didn't move around any more than he had to, now; his age was finally catching up with him. "Ah, you're here." He motioned vaguely at two chairs on the nearer side of the desk. "Sit down. How are things?"

Something's wrong, Sandy thought as she took the chair on the left. Clark was little inclined toward small talk, and he never had much time for it. Least of all now, she would think. "Not bad, with us," she said. "With things generally . . . you know."

"Yes." He seemed to ponder something. Sandy studied his face, more conscious than ever before of how old he looked. Slowly, his hair had become long and thin and gray, his cheeks sunken, his skin loose and wrinkled. He wore his glasses all the time now. But the firm set of his jaw had grown steadily since the beginning, and the eyes behind the glasses were as steady and intent as ever.

And haunted—by ghosts he had kept at bay by constant effort for over twenty years.

He snapped abruptly out of his reverie, but he still skirted whatever was bothering him. "How's Alycia?"

"Not bad." *It's still hard to believe,* Sandy thought, *that I'm about to become a grandmother. But it's true. With luck, Scott will even be home with Alycia when it happens.*

"And the newlyweds?"

"Greg and Roberta? They're fine." She frowned. "What's up, Henry? This can't be what you called us in here for."

He sighed. "No, it isn't. But it's not pleasant to talk about." He stared at the desktop in front of him. "Fifteen minutes before I called you, I received a threat on my life. An anonymous caller told me that if I don't very promptly and convincingly call off the acceleration build-up, I'll be killed and the build-up stopped in spite of me."

"Moses' gang?" Jonel asked.

Clark nodded. "He didn't say so straight out. But he didn't leave much doubt, either."

"And you believe it?"

"I have to believe it—or at least act as if I do. That call was on my private phone line, and I'm sure it wasn't anybody who was supposed to have access. Therefore it was somebody

who shouldn't—but does." He stood up carefully, pushing up with his arms on the edge of the desk and walked silently to where there had once been a window—before buildings had been so thoroughly sealed and barricaded that people spoke of themselves as living "underground." He walked slowly and a little uncertainly now, and when he stopped he stared thoughtfully at the former window as if Kennedy Spaceport were still there to see. "You know about this Moses character," he said. "We've been hearing his rabble-rousing on the comnet for some time—and whenever we try to trace one of his broadcasts and catch him, he's not there. Sometimes we find a tape—but that's all. And never in the same place twice. So far we've been able to live with it. He's built up a sizable following, but it's still a minority, and there's a fairly definite age polarization effect. His followers are young—people too young to remember Before, who can't really visualize what we left behind or what we're going toward. People who remember could never settle for what we have, so most people are still with us. But we're just now realizing—too late—how little our goal means to people who've never known anything but the trip."

He turned around and looked intently at Jonel and then at Sandy. "But there's more to Moses than that. There's more than I've told you until now. Moses talks—but he also acts. He has a much more effective subversive network than you might have thought possible, with travel and communication as restricted as they are now. People find ways. A threat on my private line is just one symptom. We've been hearing scrambled transmissions that we can't unscramble on the public talk channels. How many people can build the equipment that takes—or even get the parts? Yes, Jonel, they've got their tentacles well into the comnet. And if they can infiltrate that, why not the life support systems? We're all vulnerable there. There's already been some sabotage, trying to pressure me into changing plans. I've held out and now they're getting desperate. They threaten assassination."

Jonel nodded. "What can we do?"

"Too little that we're not already doing. You, Jonel, might try to anticipate technical angles on things they might try and countermeasures we can take. In particular, there's a danger that they'll find out where the drive control stations are. Any ideas you have for tightening security there, we need." He shrugged and laughed wryly. "As for assassination—the fact that my life is threatened is, in itself, unimportant. I'm on borrowed time anyway. I'm almost eighty-four. Have to be replaced one of these days in any case, and history won't care just how it happens. But I do want to be sure the machinery for getting my job into other hands is well lubricated. That's why I called you."

Jonel frowned. "I thought that was all taken care of. You've already told us—"

"I've shown you the file with the transition instructions in it, and told you how to get at it. It's all still there—my successor's name, with alternates; instructions to get him started; safeguards to make sure it doesn't fall into the wrong hands. But it's not enough any more. I've added some new safeguards and precautions. As my closest advisors, you need to know about them. Under the circumstances, I don't want to talk about them, even here. So I've prepared this." He walked over, took a sealed envelope from his pocket, and handed it to Jonel. "Both of you read it as soon as you go back to your apartment. Don't talk about it, but memorize it and destroy it. Right away. Do you understand it all?"

"Got it," Jonel said. Sandy nodded, a little shaken.

"There's not much more to say." Clark proved his point by saying it all in less than five more minutes. Then Jonel and Sandy descended into the network of dimly lit, massively reinforced tunnels which now linked the buildings of the complex. They did not talk. People who are as close as they sometimes need no words to know their thoughts are exploring the same territory.

Aside from personal concern for Henry's safety, two themes haunted Sandy's thoughts above all others. One was the newly vivid realization that Henry *would* have to be replaced, one way or another—and that she knew very few possible successors, and none that she really liked.

The other was the realization that whatever was going to happen—with its outcome deciding nothing less than whether the whole twenty-year plan had been wasted—would have to happen soon. It would have to happen before the scheduled beginning of buildup.

And that was less than three days off.

Clark watched them go with a feeling he might have called amusement, had it not been for the other things mixed with it. *They're rattled,* he observed. *As well they might be. But I only scratched the surface. They have no idea just how deep the rottenness runs, or how wide.*

Or how long it's been brewing.

An absolute dictator of Earth—even a crippled, mortally wounded, shell-shocked Earth, literally running scared—cannot have an easy job. Time and again, Clark had wondered how so many men in past history could have actually thought they wanted it enough to aggressively seek it.

He knew better. Earth was big. There was so terribly much to do, even with a worldwide hierarchy of subordinates to handle details, that he constantly had to drive himself as no human should be driven.

And the supporting hierarchy itself was a liability. From the very beginning, individuals and groups, neither understanding nor supporting Clark's programs, had tried to use their positions to undermine his. He couldn't

watch them all; had that been possible, he wouldn't have needed them. But he had long since accepted, as an unpleasant but necessary part of his workload, the need to spot check some of the programs carried out by subordinates. That way he found and stopped some of the plots that developed—often by the silent midnight justice he had always deplored—and hopefully discouraged a few others.

That was one matter in which he had never sought the Turabians' advice or help. That one he bore alone, doing what he thought he must and letting the casualties add fuel to the already roaring fires of his conscience. No need to inflict that on Jonel and Sandy, he had always told himself.

But now the need was at hand. This one was serious.

Tired of standing, he returned to the desk. *I get tired too easily,* he thought as he eased himself into the chair. *I should exercise more.* He thought it often, and he saw that the CIS—the propaganda mill—reminded everyone else constantly. Having become used to a slowly weakening gravity as the driving reaction ate into the Earth's mass, people who didn't exercise would find their hearts and muscles ill-prepared when the effective gravity rose to, and beyond, what had once been considered normal.

But Clark himself seldom felt like it. And there were too many excuses—too much else that he had to do.

Now he took a few minutes to rest, elbows braced on the desktop and face cradled in his hands. But his mind could not rest.

It had all seemed so simple, once. Back in the first years of the Earth's flight from its exploding galaxy, at an acceleration that put journey's end centuries in the future, morale had sunk to a level that threatened the very survival of man. There were many reasons—from boredom to resentment of human dependence on the alien Kyyra who were doing the moving—but foremost among them was that bleak prospect of centuries of desperate flight.

And if that was the problem, the solution had seemed obvious: shorten the trip. Get it over with within a human lifetime, if possible.

But that meant a much higher acceleration, with all the agony that would entail. Not as much agony as it might first seem; that would be intolerable. The Kyyra could ease the shock by a variety of means, from redirecting a small part of the drive to counteract disruptive forces, to modifying the structure of crucial parts of the shell. But the effects on human life would still be severe. The twenty-year plan was needed to prepare for them.

Now it was almost complete. And the new problem, as Clark saw it, was ironic: the plan had succeeded too well.

Back then, it had seemed critically, urgently essential to get people out of the doldrums, by work, propaganda, some semblance of entertainment—

above all, a goal. It was only recently, with hindsight, that Clark had identified the most insidious ingredient of those doldrums.

Withdrawal symptoms.

Consider the obvious ingredients: Tedious routine; totalitarian rule. Meager and monotonous diet; medical care poor and scarce. Constant exposure to a high risk of death from uncontrollable perils. All of that leading to a low life expectancy, insecurity and boredom, and no hope for improvement.

But those things have been the normal lot of man through most of the world and most of history. Yet he endured. Modern man had simply become addicted to a host of luxuries that his ancestors had never dreamed possible.

And when they were taken away from, he—like any addict—reacted unfavorably. He rebelled, he complained, he sank deep into depression.

But in time the withdrawal symptoms passed. When the survivors found themselves still alive, with the memory of their drug faded and no hope of getting it back, they learned to live with the things their forebears had always lived with. They grumbled, but they endured. Some learned to endure comfortably enough, with what little they had left and what little was added under the plan, that they would rather keep that than give it up for the new tortures of high acceleration—even for the chance of seeing sunshine again.

And those who had never seen sunshine in the first place were even less sure that it was worth the risk—or the emergency measures the effort made necessary.

But it's not all the young, Clark reminded himself. *Or only the young. I might be one of them myself, if I had nobody else to think about. High acceleration's not going to be easy on me, and I can't kid myself that I'll live to see the promised land.*

He sat up straight. *But I can't just think of myself. Or them. I know things they can't know—and most people don't agree with them anyway. We have to go through with it, at all costs.*

Don't we?

He reached out resolutely and picked up the phone. As he dialed Security, he wondered how secure even this call was.

McDugal answered—a good man, one Clark trusted as much as any. Of course, Joe Sanchez had long ago taught him—the hard way—not to trust anybody too completely.

Clark told McDugal about the threatening call on his private phone. "Check it out," he said. "Thoroughly, and fast. It should be recorded—though Moses has enough contacts in the comnet that he may have been able to block that. Anyway, start there, and go wherever it leads you. If you find a way to stop it and there's no time to consult me, don't worry about it. Just do whatever's necessary. We can talk about it later."

"Yes, sir." McDugal's image in the

small screen at the base of the phone reached out of view, moving as if he were already pushing buttons. "Anything else?"

"Yes. Arnie, if somebody wanted to attack me, how would he go about it?"

"Well, I assume it would have to be through the support systems where you are. Somehow—"

"Of course," Clark interrupted, a little impatiently. "We've assumed that for a long time. We've even taken some precautions—but not enough. I've thought of half a dozen ways the security on those systems needs to be improved—immediately. I'm sending you a memo. Get somebody on them, and cover anything else you can think of at the same time. And, Arnie—"

"Yes?"

"Be sure you do your part. The guys who do the actual work will be from Systems, but you make sure they're screened before they come here. And I mean screened." He thought for two seconds and added, "It might not be a bad idea if you sent a security agent with them. A *good* security agent."

"Yes, sir. Anything else?"

Clark smiled thinly. "You can take it from there."

He made one more call, this one on the hot line to Beldan. The small picture that formed in the phone-screen gave no impression of the Kyyra ambassador's statuesque height, but it did clearly show his face, with its big round eyes and bald pate and no obvious nose. "Bad news," Clark said. "We have reason to believe that this Moses's conspirators may have some leads on the control stations. We're not sure, yet, but if they do find out where they are they're sure to try something there. You'd better alert all your engineer crews to strengthen their security. If they find any human they're not sure of near any station, make it clear that they're to take any measures they must to keep him from getting at it."

"Any measures," Beldan repeated carefully. "Up to what?"

"Whatever it takes," said Clark, and Beldan's eyes twitched in their sockets.

"I can imagine cases," Beldan said after a pause, "in which a would-be saboteur might be stopped by nothing short of death."

"So can I," Clark agreed grimly. "Very easily."

"But if one of our engineers kills a human—"

"I'll take full responsibility. You take no chances. And don't delay. I'll keep you posted on any new developments."

"If it must be done," said Beldan, "it must be done. How about the jump induction stations?"

"They should be careful, too. But the main threat is to the drive stations. They're the ones that do what Moses wants to block right now. If he succeeds there, he doesn't have to worry about jump stations."

"True. I'll do what I can."

When Clark hung up, he left Beldan trying to compose himself with a

distraught improvisation on his music-pipe. But Clark knew he was also already composing his message to the Kyyra engineers, and would deliver it in minutes.

As he left the meeting with Moses, Brad's thoughts were troubled by the drasticness of what Moses had asked him to do. He couldn't shake off the feeling of being followed as he hurried along the chilly, dimly lit branch tunnel, his footsteps echoing too loudly off the walls. There were no tunnel bugs waiting at the platform, so he summoned one from the call box and then paced nervously as he waited for it.

It came within five minutes, a small, ungainly electric car with a single cyclopean headlight. It pulled up alongside the platform with a quiet hum and a faint scent of ozone, and stopped. Brad looked inside to make sure it was empty before he opened the door. Once inside, he felt a little more secure. He stuck his license-key briefly into its slot on the dash, then slightly tilted the joystick between his knees, taking partial control away from the autodriver. The bug slid away from the platform and turned into the main tunnel.

He drove almost automatically; he knew the route well. The tunnels were a fairly recent development, having existed within towns for several years, between neighboring towns for only a few. This one, opened when Brad was twelve, had opened a new world to him—a world of personal contact with more than a handful of other human beings—and he had used it as much as possible from the start.

Sometimes he dreamed of expanding his world still more, of traveling tunnels that linked not only nearby communities, but distant cities. But such tunnels did not exist. If the acceleration was raised as planned, they never would, and any travel beyond the most provincial would remain virtually impossible for ordinary people.

Yet another reason, he thought, *for supporting the Movement. So what's bugging me?*

It was not, he told himself, that he had doubts about what he was doing, or whether he would in fact do it. He had his father's ability to size up a situation, make a decision about it, and act on that decision without looking back. Unfortunately, like so many people these days (or had it always been thus?), he had reached a decision that was different from his father's. Never again, he knew, would their views come back together—or be compatible.

That was sad, but could be accepted. But did it have to mean getting mixed up with such sordid things as this plot? Did it have to mean dragging Rosanne into it? For he was. Not directly, but the very fact of calling her Rosanne—of calling her anything but her real name—was an involvement, and he resented it.

Another bug whizzed by in the other direction, its headlight beam splattering into little rays of brightness in the scratches in Brad's wind-

shield, and then was gone. *I'm at a crossroads,* he thought with a grim amusement, alone again in the blackness. *With what I know now, I can get the Movement over the hump. Or I could blow the whole thing wide open and put an end to it.*

Or could I? Moses uses drastic means to his ends, too. What was that he said about precautions? Maybe that communicator he gave me is more than just a communicator. It could be rigged to monitor everything I say—and explode if I say the wrong thing.

That, he decided, was what bothered him most. Not the possibility of a personal threat, *per se,* but the shock of finding that Moses, so idealistic in his broadcasts, would use such cold-blooded expedients because of "emergency."

Just like Henry Clark.

So how was Moses better?

He was better, Brad told himself sternly, because he offered a chance for continuance of the good things they already had going, and the end of at least some of the bad.

And there *were* good things going. Looking back, Brad could remember a multitude of happy sights and sounds and feelings, centering about days and nights of conviviality with Rosanne and their friends in Titusville. And he could imagine still better things to come, with them and the children he and Rosanne would have.

If they didn't have their world turned up on end and shaken to pieces, figuratively if not literally, by high acceleration. And if they could cast off the yoke of Clark's "emergency" regime.

Are those things, a voice within him asked, *as good as what we could get on a new planet?*

He wasn't sure. But certainly, from where he sat, they were more real.

And so were things like the ever-looming specter of the work draft.

The buzzer sounded in his earphone and the alarm beacon on the barracks winked red and green, red and green . . .

Sagittarius was rising.

Wearily, Scott Turabian put down his tools and looked across the rolling but otherwise featureless plain at the southeastern sky. He recognized some of the pinpoints of light against the blackness there, but he couldn't see the one that mattered. The galactic center had not yet grown bright enough for its visible light to show through the thick clouds of dust. But less obvious, less friendly radiation had been getting through for quite some time.

Normally, for that reason, the buzzer and beacon would mark the end of the work day and time to retreat to the barracks. But not any more. Now it was just the shift change. There was too much left to do, and too little time, for the work to ever cease.

For a moment Scott turned back to survey the unfinished induction station with quiet dismay. From his perch high on the framework, he could see the whole thing, black and

shadowy under starlight, but its outlines clearly traced by lamps strung along its beams—like dewdrops on a spiderweb, Scott's mother might have said. Scott had never seen a spiderweb, but he could see the resemblance to things she had shown him in pictures. The resemblance went only so far. This thing had none of the delicacy of a spiderweb, and it was much more three-dimensional. It sprawled over thirty acres, partially sunk in a deep pit so its towers and ramparts could not topple when it tried to lean.

Human figures, tiny by contrast, scurried along the beams and down ramps and ladders, merging into a single stream bound for the barracks. Ironic, Scott thought, that they had built this thing, yet none of them understood how it worked.

It was enough that the Kyyra did. When the time came, it and others around the world would induce the transition to super-c. Even the stars would vanish from the sky, and the Earth would hurtle onward in solitude, chasing the unseen galaxy M31 at speeds up to a million times that of light. It would be almost six years before the stars came back . . .

And then man and Kyyra would find a new home.

Scott had hoped the jump stations would all be finished and he would be home by now, or at least before the acceleration toward jump speed began to build up. But it didn't look likely. Not with barely two days left.

He started down the ramps, his skintight protective suit bending reluctantly with his body. He passed men streaming out for the new shift, their suits doubly reinforced against radiation, and went directly to the barracks and the low-ceilinged room he shared with eighty other men, packed in like sardines. (Another obsolete simile, but still in wide use for lack of a better one.) Once through the lock, he peeled off his breather mask. At his cot, he traded his suit for the tattered but reasonably comfortable outfit he'd brought from home. As he finished changing, amid locker-room chatter and smell, and stashed his work gear in his footlocker, he saw Luis Mamani standing by the inner door, watching his work crew come in. Like a mother hen, *Scott thought, knowing how that infuriated Mamani. "Hawk," the foreman insisted his Inca surname meant, and that was how he wanted to be regarded.*

It was not, at least in its more favorable connotations, how Scott regarded him. Especially now. He walked over to the crew boss and asked, "Do you think we'll make it in time?"

Mamani looked down his long, hooked nose at Scott. "We will make it."

"In time?"

Annoyance flashed in Mamani's black eyes. "We will make it when we make it. We can do no more."

The anger which had been lying in wait began to stir. Scott gestured at the room around them, at the shod-

dily built and poorly reinforced walls. "What about this? If we're out before the build-up starts, fine. But if we might not, shouldn't we be spending these last days reinforcing our quarters? This place isn't ready—"

"It is strong enough."

"Marginally, even on paper. We need to be sure."

"That is my concern. Not yours."

"I have a small stake in it," Scott snapped. "I have a wife back home expecting a baby in a few weeks. Even if I never see her again, I want to be sure they finish the trip."

"They will finish."

"But if the crew gets wiped out and the—"

With a surprisingly slight shift of his body, Mamani loomed threateningly. "Look, Turabian, I am in charge here. I do not have to listen to your insolence because you are Jonel Turabian's son. Now, are you going to bed like a good boy? Or are you going to continue this and make me do something neither of us likes?"

Scott stared at Mamani's leathery face for many seconds, seething. But in the end, he said quietly, "I'll go." He turned.

"You'll go, what? Turn around, Turabian."

Scott stopped and turned slowly. He had to force the words out, without meeting Mamani's eyes. "I'll go, sir."

He returned slowly to his cot, thinking. Mamani and his kind, their judgment warped by petty power, could cause whole companies to be wiped out, leaving their projects undone.

And if that happened often enough, the biggest project of all could come to nothing.

Briefly, as he crawled into his cot, Scott considered taking his frustration to Sklynel', the Kyyra overseer of the Salina Station project. But it would do no good. Sklynel' was too shy among humans, too reluctant to interfere in their affairs in any but a purely technical capacity. He made Beldan look like a social climber. And Scott's willingness even to talk to Kyyra had already brought him too much trouble with his human coworkers.

So the idea faded quickly. And the lights faded as soon as he was under the sheets.

Staring into the darkness between himself and the ceiling, he found himself thinking of Alycia. He imagined her slim, almost frail form; the pale, smooth skin and hair that bespoke her Scandinavian ancestry; her voice and smile, which could be tremendously soothing—when she wanted them to be.

He wished she were lying next to him.

Strange, he thought, that he should miss her so now. Thrown together by Matchmaker at eighteen, they had both found the first months stormy and uncertain. Scott had gone into it handicapped by a childhood allowing little direct contact with other people—especially those near his own

age—before his teens. The tunnel to Titusville had come too late. Alycia Svensson was the first girl he had got to know well—and he met her the day they were married. She was somewhat better off, having long had access to the older tunnels within Titusville. Nevertheless, she came into marriage unwilling, resentful, sullen, with an overdeveloped talent for sarcasm. There was ample fuel for needling and quarrels. Their family backgrounds differed greatly. Scott was close to Clark and Beldan; Alycia had a distrust of them acquired in her association with a wide range of other humans. Assigned to the tiny spaceport community instead of her home town, she felt stranded, cut off from civilization, even though that was no longer really true, with the tunnel developed as it now was.

From such beginnings their marriage had had to grow, and, almost miraculously, it had—at least, it had made a good start. Scott, imbued since babyhood with the worth of the trip and its goal, had endured stoically at first—not happy, but quietly determined to make it work. Gradually—very gradually—he had begun to get through to Alycia. Cautiously, she began to change, to let him closer. As their first year progressed, he began to see some faint glimmering of what life together could be.

And he wanted more and more to make it that.

Just when they were becoming hopeful—just five months after their marriage and a couple of weeks after Alycia knew she was expecting—Scott had been work-drafted. Ripped away to serve in places like this, working for people like Mamani on jobs like building induction stations or cannibalizing houses full of death.

They kept in touch. Not often enough, but whenever possible. They talked about the baby, and they both had a lot of time to think.

And now he missed her.

Restlessly, he rolled onto his side. Seeking sleep, he tried to imagine walking on the surface of a planet, with no special suit or mask, under a clear blue sky made light all over by a single star so huge it looked like a disk and so bright no others could be seen. The ground covered with soft green leafy things that waved in the breeze and smelled good, with animals of all shapes and sizes wandering about . . .

(The only animal he'd ever seen was Ozymandias the Mutt, and Oz had died of old age before Scott was eight.)

Maddeningly, the chain of thought led back to an early conversation with Alycia. She'd been chiding him about being so determined to get to a new planet, and he'd been thrown on the defensive. "You don't know what it's like," he told her. "You should hear my mother tell about Earth before the trip. Or sing about it . . ."

"I have," said Alycia. "She recorded some of those songs for the comnet, remember?"

"Well, she wrote them for me. And Greg."

"Touching." Alycia could be exasperating at times. "Old people always exaggerate about the good old days."

She's not old," Scott snapped. "She's not even fifty."

Now, trying to get to sleep in a barracks somewhere on the Great Plains, he added to himself, "And she's not exaggerating. She's telling the truth."

"She has to be."

Alycia called Sandy quite late at night. Sandy didn't mind; she wasn't getting to sleep anyway, and she welcomed any sign that Alycia was feeling more like one of the family.

But Jonel was already asleep, so she left the light out—except the little phone-screen—and spoke softly. "What is it, Alycia?"

Alycia smiled apologetically. "Sorry to bother you, Sandy. I couldn't sleep."

"That's okay. I couldn't either. What's wrong?"

"Scott. I haven't heard a thing from him lately."

"Well, there are a lot of people on work crews, and only so much radiogram equipment in the field. You've never heard from him often, have you?"

"No, but now's special. He's supposed to be home before the build-up, and there's only a couple of days left. Do you suppose something's happened?"

Sandy studied the image for several seconds before answering. Alycia wore an elaborate, frilly nightgown that did not hide her ripely bulging shape. It was beautiful, and she had made it herself—from the same roughly recycled materials which in most people's hands became the severely functional, multiply-patched garments now in almost universal use. "I doubt it," Sandy said after a while. "But we can't be sure."

"You can't get Mr. Clark to find out?"

"I'm afraid not. All we can do is hope for the best and brace for the worst."

"I'll try. But I can't help worrying. About him—and myself. I'm a little afraid, you know. I really am."

"Afraid?"

"Of the build-up."

"No need," Sandy said, showing a little more confidence than she felt. "Remember, we've spent twenty years getting ready. Even if it seems a little scary, the place you're in can take it."

"And Scott? What if he's still up there when—"

"Any place with people will have to be prepared too." Sandy tried to change the subject. "How's the baby?"

Alycia grinned. "Alive and kicking—usually when I'm trying to sleep." The grin ended abruptly. "I'm a little afraid about that, too. Does having a baby hurt much?"

"It can," Sandy admitted. "But quite a few worthwhile things do, for a

while. Just remember what your doctor and I've told you, and you'll be okay. How are you feeling?"

"Pretty good, mostly. I have spells once in a while. I wish Dr. Hartzel could see me oftener."

"It would be nice. But doctors can only do so much, and there aren't nearly enough."

"I guess. Well, thanks, Sandy. You've been a help. I won't bother you any more. Good night."

"Good night, Alycia." Sandy didn't look away from the screen until some time after the image had faded. Alycia, she reflected, was still burdened by more than her fair share of fears and anxieties. But she'd come a long way since her marriage to a stranger whose main point in common with her was that he wasn't ready for it either. They'd both come a long way.

As she crawled back into bed, Sandy was very conscious of how fortunate she and Jonel had been to be able to choose each other. Their younger son, Greg, had had the same good fortune in finding Roberta, but that was regrettably uncommon these days. But then, Greg's path had always seemed smoother than Scott's. He'd adapted much more readily to the social life in Titusville—he'd been visiting friends there just today—and in so many ways seemed to draw more pleasure and less pain from life.

Eventually, Sandy hoped as she fell asleep, some of his luck might yet rub off on his brother . . .

"Yes, Beldan." Clark, increasingly harried, began to grow impatient. "I'll call McDugal right away. We'll do what we can. Meanwhile . . . if you should be directly threatened, don't hesitate to act on your own."

He hung up.

For a moment he sat staring absently at the phone, too conscious that he no longer bore the pressure as well as he used to. The "Movement," he thought, was getting desperate. Only desperation, brought on by the closeness of the deadline, could explain the rebels' appealing directly to the Kyyra. Surely they must know how determined the Kyyra were to complete the trip as quickly as possible. Clark very vividly remembered how stubbornly Beldan had resisted his early, misguided efforts to keep the acceleration low.

Admittedly the call Beldan had just received was not an actual threat. It was a fairly calm, reasonably-worded plea for reconsideration, offering arguments, and containing only one pointed reminder that the Kyyra would be dependent on human help when the time came to colonize a new world.

That was how their campaign against Clark had started, too. Reasonably, lawfully presented petitions with considerable backing—which Moses could never have expected him to accept. Their real function had been to undermine support for Clark by making him look unresponsive to the desires of the people.

Thus paving the way for the more sinister measures of the real revolu-

tion that was going to follow.

Beldan had learned enough to guess that threats would soon follow in his case too. Especially since his call, like the earlier one to Clark, had been on what was supposedly a very private line.

Still more evidence of how deeply the comnet had been infiltrated.

And the incidence of sabotage and terrorism had increased within the last day.

Clark shook off his torpor and picked up the phone again. McDugal looked surprised when he answered. "Ah, Mr. Clark. I was just about to call you."

"That's good. I'd been wondering why you hadn't. Look, Arnie, I was just talking to Beldan. He got a call, too."

"Assassination threat?"

"Not yet. But he's afraid that'll come next, and he's probably right. He wants more protection."

McDugal looked harried, too. "I'll try," he said—a little doubtfully, Clark thought. "We're terribly busy just now."

"Aren't we all? But we do what we must. Do this. You know we can't let anything happen to him."

McDugal closed his eyes momentarily. "Yes, sir. Anything else?"

"Plenty." *I'm getting nasty,* Clark thought. *I don't want to, but lately it always happens at times like this.* "It's been over a day since I talked to you about tightening my security, and I haven't heard a thing. Have you traced that call?"

"I'm afraid not. We tried. But they blocked it, just as you said. So I've had men rounding up and grilling all the known or suspected revolutionaries they can find."

"And?"

"Nothing. Not much, anyway. But we're still working on it."

"Hmph." Clark Scowled. "Well, when are you going to fix my systems? Over a day, Arnie. That's a lot of delay on something like this. What's up?"

"Sorry. As I understand it, Systems got into some internal hassle about which of two ways to do something. But—"

"I could be killed while they do that. Doesn't anybody over there know the meaning of emergency?"

"As I was saying, sir, they should be coming soon. I'll check on it."

"Do that." Clark pressed his lips tightly together. "You said you were about to call me."

"Yes. Bad news, I'm afraid. You knew the conspirators were trying to locate the Kyyra control stations and get saboteurs to them—"

"Yes?" Clark straightened up abruptly. "They've succeeded?"

"Not yet. But we've intercepted communications that indicate they know where at least some of them are."

"That they really do, or they want us to think they do?"

"They really do. Unfortunately, we don't know exactly which individuals do, or where they are. We're afraid some of them are on their way. That

would mean they're somewhere on or above the surface, in commandeered vehicles. There's a lot of space out there, all in the dark, and not many men or vehicles available to search it. And some of those could be rebel saboteurs who've infiltrated legitimate surface parties to gain safe passage to their targets."

Clark began to feel trapped. *I don't know why,* he thought. *I've been handling this kind of pressure for almost a quarter of a century. I hate to admit it, but I guess I am getting old.* "Do what you can," he said.

"It's not going to be enough," McDugal said bluntly. "Not the way it is. I've told you we're already busy. You've just thrown me another job. There aren't many vehicles outside, but there are too many to find and search them all. I was hoping you'd help."

"What can I do? I'm busy, too."

"We need a way to filter out suspicious vehicles. If you could—"

A flash of his old insight stirred in Clark's mind. "Suppose," he broke in, "I issue a general ban on intercity travel until further notice. It would be nice just to stop it in the vicinity of the control stations, but I don't see any way to do that without giving their locations away to more people than already know. If we order all motion to stop—any saboteur who complies isn't getting any closer to his target. Any who keeps going, your agents can pounce on, and they'll have a lot fewer to worry about."

McDugal brightened with relief. "Very good, sir. That should help a lot. The only thing that bothers me is that some of the jump stations aren't finished yet. We may block the flow of needed supplies—"

Clark nodded. "True, and I don't know how much we can do about it. But if the drive stations can't raise the acceleration, the jump stations aren't going to be worth much, are they? I'll try to include some provision for legitimate supply crews to be identified and sent on their way as quickly as possible."

"Good idea. But that takes manpower, too. What if they're still delayed too much?"

"We'll just have to try to see that that doesn't happen. But if it does . . . well, jump stations can be worked on after the build-up starts. We'd hoped they wouldn't have to, because it'll be harder and more dangerous. But it's not impossible. If it has to be done, it'll have to be done."

"Yes, sir. I guess that's the best we can do. If I think of a way to improve on it, I'll let you know."

"Only if I need to know, Arnie. Otherwise, just do it."

Clark hung up and closed his eyes, breathing heavily. Arnie was right. There was too much. But it all had to be done, somehow. Measures like the one he'd just suggested were full of unpleasant possibilities, but at this point might well be the least of the available evils.

Even so, they might not be enough. As Arnie said, blocking the saboteurs, even this way, bore a marked resem-

blance to needle-hunting in haystacks.

Would it work?

For a painful moment, Clark thought of the plot succeeding, destroying all the work of the last twenty years, hurling the dream of a normal, sunlit life back into the inaccessible future from which it had been so laboriously wrested . . .

That was so painful his mind drew back from it like a burned hand. But there were other specters closer to home. He thought of what he had told Arnie about jump station work continuing into the build-up, and that reminded him that some might have to do that anyway. The one at Salina, for instance, was cutting its schedule dangerously close . . .

And Scott Turabian was there.

He tried not to think about that, either. But the thought lingered—and, quite abruptly, it suggested one more idea. He opened his eyes and thought hard about it, staring at the wall where the window had been.

He was pretty sure it could be done, though he would have to check with Beldan. But it was so drastic he couldn't bring himself to actually do it. Not yet, anyway.

When the pocket communicator woke him with its quiet but insistent beeping, he almost forgot he was Brad and said his real name. But he remembered in time. Groggily, afraid the thing would wake Rosanne, he shut off the beeper, held the pickup end near his mouth, and whispered, "Hello?" He glanced nervously at Rosanne. He couldn't see well in the dark, but she seemed to be sleeping.

"Brad?" said the communicator.

"Wait a minute." He got out of bed with as little disturbance as possible and tiptoed barefoot across the slightly warm floor to the bathroom. He closed the door, turned on the overly bright light, and sat down. "O.K. I can talk now."

"This is Moses, Brad," the voice said unhurriedly. "Time's getting very short and our other measures haven't been completely successful, We'd like you to help us in the morning. Are you ready?"

Brad didn't answer right away. Images passed through his mind, faces of people he would hurt if he agreed, and of still more he would hurt if he didn't. The personal danger, oddly, didn't even enter his mind. Finally he sighed, "Yes."

"Good. You understand the priorities?"

"I think so."

"Tell me."

"I'm to persuade if I can, kill if I must." He thought about that. What were his chances of persuading? Not at all good, he feared. "And if both of those fail . . . what?"

"Don't fail," said Moses. "There's only one alternative beyond those, and we're not sure it'll work. We've located most of the control stations and we have agents on their way. But we're still not sure of a couple of the locations, and Clark's learned enough to make it hard for our people. There's

a good chance they'll make it, but you shouldn't count on it. It's strictly a last resort, anyway. If we're forced to tamper with the stations, we may unknowingly disturb their operation at their present level instead of just blocking the build-up. Obviously, we'd rather not do that."

"I understand."

"Excellent. Let's go over some details . . ." Moses spelled out the specifics, tersely but thoroughly. "Carry your communicator," he concluded, "and call us at once, win or lose. If you fail, the saboteurs will have to go ahead, if they're able. If you succeed, we'll have to be sure they don't. And if we don't hear from you—we'll have to assume you failed. Good luck, Brad."

"You'll hear from me," Brad said. The communicator made no reply.

He turned out the bathroom light and returned slowly to bed. He was relieved that Rosanne still showed no signs of waking. He tried to go back to sleep until morning, but with little success. His thoughts were too active—and this time, spurred by Moses' parting words, they included a few about the danger to himself.

He was awake when the room lights began to come on. As they crept almost imperceptibly toward their "daytime" levels, Brad looked at Rosanne, her face tranquil on her pillow and long black hair streaming behind, and decided he didn't want to talk to her before he left. He got up carefully and dressed slowly, half afraid she would wake up and ask him where he was going. When he finished, and made sure he had the two things he needed, the lights were halfway up and he could see her and the room fairly clearly. He let his eyes wander around, ignoring the poor furnishings and bare recycling gear, dwelling on the other things—personal items of Rosanne's, pictures on the walls, small gifts from friends in Titusville. He bent over to kiss Rosanne as she slept. *I'm doing this for you,* he thought. *And us, and all the others. I hope you'll understand that—if you ever know.*

And then he squeezed all sentimentality out of his mind and went out to wander the tunnels until it was time to do what must be done.

"Then you can do it?"

"Yes," Beldan said. "Everything's ready, as far as that goes. I'll alert all the station chiefs to be ready. And if the need should arise, you'll call me?"

"Yes," Clark nodded. "Or buzz you. I'll try to have that special alarm button added to my end of the hot line. But I don't know if I'll get the chance."

"Hopefully," said Beldan, "we won't have to use it, anyway."

"Hopefully." Clark hung up. *Last night,* he thought, *I hoped I wouldn't even have to mention it to you. But that was last night.*

He still felt a little groggy. He'd been to bed too late and up too early, even by the grueling standards he'd been used to for years. Such sleep as he'd had had been rudely punctuated

by a series of new calls on his private line, warning him that he'd better act soon on the Movement's ultimatum. The last two, with pointed references to his "last chance," claimed to be from Moses himself. But Security was unable to trace any of them.

Very early in the morning, McDugal had called with a new and unencouraging report on the conspirators' progress toward the control stations. Two saboteurs had been intercepted, but the chances looked better than ever that they would reach at least two stations. That would be enough to force postponement, at least, and Clark could see no advantage in that. So, finally, reluctantly, he'd called Beldan to set things up for the one new option he'd thought of.

As he sat at his desk thinking over the call—and in particular his reference to a special alarm—he realized with a flare of anger that Systems has still not been here to tighten the security on his life support.

And that he'd been too busy to even think of it since yesterday afternoon.

Scowling, he rang up McDugal and snapped, "This is ridiculous, Arnie! Almost two days. If you don't get somebody over here right away—"

"Sorry," McDugal interrupted curtly. "They're on their way. You don't want me to waste time explaining the reasons, do you? They'll be there. If they're not there in twenty minutes, call me back."

He hung up before Clark could. Clark seethed briefly, then deliberately calmed himself. He tried to work on the pile of papers on his desk—the pile that seemed never to have got any smaller in the last twenty years—and then thought of a way to speed things up.

If a Systems man ever got here.

He arrived nineteen minutes after Clark talked to McDugal. By that time Clark had finished the diagram he'd been working out on a magic slate. "I'm coming," he grumbled when he heard the knock, and he thought, *I sound like a grumpy old man.* The slow, awkward gait with which he went to the door did little to restore his self-image.

He checked through the peephole before he opened the door. He didn't relax completely even when he saw the young man in the blue-gray uniform of a Systems maintenance tech, but he did open the door.

"Systems," the man said. An assortment of tools dangled at his belt. "You requested some work, Administrator Clark. My credentials." He fished a worn imitation leather pouch from a pocket and passed it to Clark. Clark inspected it carefully. Identification card with a picture that matched the face and a name that matched the one on the uniform . . . job authorization, correct and detailed . . . security clearance . . . approval stamps and countersignatures from complex and building guards . . .

Everything seemed in order. Clark handed the pouch back. The tech said, "I need to get at some connections in here. May I come in?"

"Certainly. It's about time." Clark stood aside to let the tech in and close the door after him. "I have a small last-minute addition to the work order." He returned to the desk and got the diagram he had drawn. "I know you're not a phone specialist, but you're here and this is urgent. Can you do it?"

The tech studied the drawing for a few seconds. "Sure."

Clark paced the room, never taking his eyes off the technician as he worked, both under the desk and on the things he had originally come to fix. *Do all dictators become paranoid?* Clark wondered. *I think we must.*

The tech worked for less than half an hour, but Clark felt definite and strong relief when he finished. Clark escorted him to the door, showed him out, and was about to lock the door after him when he heard rapid footsteps and a familiar voice from the hall.

"Henry, do you have a minute?"

"Greg!" Clark smiled as the bright-faced, curly-headed young man drew to a halt outside the door. "Not much time to spare, I'm afraid. But you know I'm always glad to see you. Come in." He turned and started back to his desk, leaving Greg to close the door. Clark's closeness to the Turabians had begun before the trip, grown steadily, and extended automatically to both their sons. He needed such people, at times, to keep him convinced the race was worth saving. "I haven't seen you for a while," he said as he eased himself into the desk chair and motioned Greg to one of the others. "Been busy?"

"Partly," said Greg, making himself comfortable. "And visiting friends. And getting used to having Roberta around the house." He grinned.

Clark grinned back. "How is Roberta?"

"Just fine." His expression grew serious. "Except she's worried."

"Worried? About what? I can't imagine what she'd worry about that you or Sandy couldn't help her with better than I could."

"The build-up," said Greg, and Clark felt a twinge of surprise. "She's afraid of it. So's Alycia. Especially Alycia, I think, with her condition." He hesitated. Clark thought he saw a peculiar unease in Greg's manner, so subtle and unfamiliar that it took him a while to recognize it and even longer to have any inkling of what it might mean. "I know I couldn't ask you to do anything about it just for them, but it's not just for them. I was in Titusville a couple of days ago, and there's a lot of the same kind of feeling. They asked me to talk to you."

Clark frowned. "Well?"

"They want me to ask if you could delay the build-up."

Clark looked at him for a long time, startled. Something in a remote corner of his mind squirmed uncomfortably, but since this was Greg, it did no more. "Well, Greg," he said finally, with a light laugh, "I've had the same kind of pleas before every major tran-

sition in the whole trip. I think you know why it's impossible."

"Is it, really? Completely impossible?"

"Yes." A memory stirred, of the one time Clark had allowed himself to hesitate on such a point. He found himself staring at the new row of switches the tech had installed under his desk, and jerked his eyes self-consciously away from them. "Yes," he repeated, "it's impossible. How long a delay are they talking about?"

"Long enough to convince everybody it's really the thing to do. That it's safe enough—and worthwhile."

"Everybody?" Clark said softly. "A long time ago, Greg, I was desperately hoping to get everybody to agree on something like that. I was very naive then."

"Were you? Or were you maybe wiser? Maybe you've lost something."

"Probably." Clark nodded slowly. "Probably both, in ways. But I can only do what looks right and necessary to me."

Greg's unease gathered itself into impatience. "But if it's so right," he demanded, "why can't you show us why? Look, Mr. Clark"—(he had almost never called Clark that since he was very small)—"you forget that some of us never saw the kind of life you say you're taking us to. We don't feel sure it's real—or that we'll like it. But we know we have the makings of a decent life here—if we don't have to worry about high acceleration."

Clark looked at him sharply, suddenly very conscious of what had been bothering him. "You sound like one of them."

"Them?"

"Moses. The so-called Movement."

Greg smiled. A rather ordinary smile, superficially—but it was the most chilling thing Clark had ever seen. "That's right," Greg said quietly, producing a tiny pistol from a hidden pocket. The smile vanished. "Fold your hands on your desktop, Mr. Clark. Moses calls me Brad."

Clark obeyed, moving slowly. *It's time for those buttons,* he thought. *But . . . this is Greg. And he knows Moses. Maybe I can still talk to him.* "Well," he said, carefully keeping his voice and manner calm, "this is a surprise, Greg. Not a pleasant one, I admit. I wouldn't have thought you'd be taken in by such blatant demagoguery."

"It was his or yours," said Greg. He held the gun and his gaze unwavering on Clark. "It took a while, but I finally decided his makes more sense."

"To you. Not to your father and mother. Have you thought about how it will hurt them if you succeed?"

He'd hit a nerve. The gun didn't budge, but for an instant Greg's eyes dropped and torment clouded his features. He nodded almost imperceptibly. "Yes. And that's the real tragedy of it—that we can't both have what we want." The confident, almost fanatical facade snapped back. "But we're going to have to live with it longer.

And our way is better for the next few generations. Isn't that how you decided?"

"More or less. But have you really thought about it? Have you thought about why people have been less miserable under the twenty-year plan than before? Largely because they've been kept busy and the end was in sight. Do it your way, and we'll go back to what we had before. You don't realize how bad morale got in those days, Greg. We would never have gone to the plan if we didn't already know the alternative was worse."

"And the work draft?" Greg challenged. "The contraceptive laws? Matchmaker?"

"I've hated them as much as you. But we were dying off a lot faster than we were being replaced, and voluntary measures weren't working."

Greg made a contemptuous noise. "That's what you say. Moses has other ideas. Why should anybody have to go through what high acceleration means, when our descendants could get there in a few generations just the way we're going? And we could have easier lives in the meantime."

Clark shook his head, more with sadness than anything else. "I had those ideas over twenty years ago, Greg. I thought they'd work, then. I really wish I could make you see how wrong I was—but apparently I don't know how." He looked hard at Greg. "But you make me surer than ever that we have to go through with it. If one generation can forget as much as you have, what would happen if we let it stretch out to fifteen or twenty? Who would remember even enough to get things going after we reached a new planet?"

Greg looked uncomfortable, but made no direct answer. He just said, "I'm sorry that's your attitude. They thought maybe I could persuade you to see it our way. I really hoped I could, because I've always liked and respected you, Henry. I still do. So I hate to do what I must. But you leave me no choice. There's more to care about than you." The muzzle of his gun shifted slightly.

Clark felt his heart hammering and his throat drying out, but he somehow kept his voice steady. "You actually intend to use that thing?"

"Yes. If you won't change your mind."

"Why?"

The gun twitched with exasperation. "You're making this very hard. Because the Kyyra have had all their dealings with you, obviously. With you gone, they'll *have* to delay, at least long enough to make the transition to a successor. That gives us more time."

"Not as much as you think. We've always known I might have to be replaced suddenly. We've made arrangements." *What am I waiting for? I should have already done it . . .* "We've made other arrangements, too, Greg. You know, if the build-up had already started, you'd have to rethink your whole scheme, wouldn't you? Your number one goal would be

gone forever. Would it still be worthwhile to kill me?"

Greg's uncertainty showed for less than a second, but it was unmistakable. "What are you getting at?"

"Very simple. We've anticipated most of your moves—including your last-ditch offense that you don't want to use. We have a last-ditch defense that we don't want to use, either. But, as you say, you leave us no choice."

"What—what are you saying?"

"We start early." And as he said it, shaking with regret that he dared delay no longer to make sure it was necessary, Clark slammed his leg sideways against the new switches under the desk. Simultaneously, Greg moved his hand as if to shoot, and then yelled a startled oath as the lights died. He didn't dare shoot in the dark; there were life support devices he couldn't risk hitting. But there was a clatter and scuffle as he sprang from his chair, kicking it over, and came around the end of the desk, knocking papers to the floor.

An electrical call had already gone out for Security guards, and another was sounding Beldan's hot-line buzzer continuously. Both would trigger immediate action, but immediate meant at least seconds. Meanwhile Clark felt Greg's strong hands grabbing his throat and squeezing, wrenching, lifting him out of the chair and throwing him to the floor. He hit hard. A twisting pain shot through his right ankle and echoed through his whole body. But the worst was in his throat. The hard fingers pressed into him until it seemed that their tips must meet. *I,* he thought with crystal clarity through a haze of pain and fading awareness, *am being strangled.*

The fact seemed neither particularly exciting nor even particularly real. Another flashed by—*Greg couldn't do this. Not Greg!*—and was gone. He couldn't breathe. He felt consciousness going and struggled to hang onto it.

Dimly, he heard steps outside. Then a hard blow, a wrenching sound, and the door flew open. The lights came on and a blur of green and gold flurried by the door. *Security guards,* Clark remembered with an effort, forcing them almost into focus. *I sent for them . . .*

One of them was lifting a black gun to point at the maniac (Clark couldn't remember his name) who was strangling him. The fingers let go of his throat, and he dimly remembered that there was some reason why he didn't want the assassin killed, though he couldn't remember what it was. He tried to call out to tell the guards.

But the only sound that came was the sharp *crack* of the guard's gun. The assassin flew backward off him with a grunt, slid across the floor and lay quiet. There was blood . . .

A voice deep in Clark cried out to him that something was very wrong. Then a reddish-black gauze curtain slid gently across his world and lights dimmed behind it.

"You'd better come right away," the guard on the phone told Sandy.

Something in his voice made her sure he wasn't exaggerating. She fought to keep her apprehension under control as she relayed the message to Jonel. But they half ran the whole distance, and her head swam and Jonel's face went pale as they reached Clark's open door and looked in.

Henry lay on his back near the desk, apparently unconscious, his face and neck red. Near him sprawled Greg, equally motionless, his shirt drenched with blood that spilled onto the floor around him. A guard in a faded uniform stood uncertainly over Greg, still holding a pistol. Another pistol lay on the desk. Another guard stood near the door. A smell of burnt powder hung in the air.

The scene blurred through the film that filled Sandy's eyes and the fury that filled the rest of her. She could barely get words out. "What happened?"

The guard near the door stepped toward them, almost as pale as Jonel. "We're not sure, exactly," he said woodenly. "We got a call on Mr. Clark's emergency alarm and came in. The lights were off and we heard fighting. When we got the lights back on, we saw a man trying to strangle Mr. Clark. It was clear-cut: Frank shot him. We didn't know it was your son until afterward." He lowered his eyes. "I'm sorry, Mr. and Mrs. Turabian. I don't know what else to say."

Sandy didn't answer. She tried to keep her eyes off Greg, but they kept being drawn back. The other guard, having decided he was harmless now, knelt beside Henry, checking his pulse and breathing. Jonel asked, "Is either of them alive?" Some of the color had returned to his face, but not enough.

"Clark is," the kneeling guard said without looking up. "Your son isn't." Clark stirred and made incoherent little noises. "He's coming around, I think."

Jonel went to kneel beside Clark. Sandy followed. Clark's eyelids flickered, then opened. At first they were blank, but then he seemed to recognize Jonel and Sandy. "What . . ." The word came out so badly that he cleared his throat and tried again. "What happened?"

"Just what we were going to ask you," said Sandy, even more roughly than she intended.

Clark closed his eyes again. After a few seconds he reopened them, but didn't look directly at Sandy or Jonel. "Oh, yes," he murmured. "I don't know how to tell you this. Greg . . . is with the Movement. Moses sent him . . . to assassinate me."

Sandy closed her eyes, almost too numb for the shock to register. She would never have dreamed it before, but with hindsight, it made a bizarre sort of sense. Greg had always seemed less responsive than Scott to her tales of old Earth and the promised land, and more so to social pressures. That had made him seem unusually well adjusted—but it had also made him more susceptible to revolutionary influences, and given him more to value in the status quo. And few people on Earth were as well situated as he to

attempt what Clark said he had attempted. It was shocking—but not incredible.

"How is Greg?" Clark asked, almost inaudibly.

"He's dead," said Jonel.

Clark winced. The guard was bandaging his ankle. "Oh, Lord. I tried to stop them; I really did. I didn't want them to kill him."

"Why?" Sandy demanded fiercely. "So he could lead you to Moses?"

"Partly," Clark admitted. "But you know there's more to it than that. You can't believe I wanted this to happen." He paused as if searching inside himself. "Maybe I tried to talk too long. Maybe I should have called the guards sooner."

And maybe, Sandy thought bitterly, *you just didn't care that much. I'll try to understand, Henry, but it's not easy. All I see is that you're responsible for our son's death.*

And he was mixed up in something that wanted to destroy everything we've been living for.

I don't know which bothers me more.

"Maybe," she said finally, coldly. "I don't know. All I know is . . . I don't see how I can work with you any more. Not after this."

Clark tried to sit up, failed, and fell back in pain. "Oh, but you must!" he said earnestly. "More than ever. I'm not going to be much good for a few days, and you two have to pull things together. Listen . . . they were very close to stopping us. I arranged with Beldan to start the acceleration buildup early if we ran out of other alternatives. When Greg attacked me, I knew the time had come. I didn't like it, but I gave Beldan the signal at the same time I called the guards. The buildup will be starting any minute now." He looked at Sandy, pleading. "You see what that means? There's going to be panic, and then anger, fanned by Moses. You have to calm them. You have to make them understand why I did it."

Sandy stared at him for a long time, astounded at his request. "Just how far do you think I can go with justifying your excesses? Maybe you were all right, and Greg was all wrong. But he was my son. I have to live with my feelings." *And I understand how he felt, to some extent. I'm only sorry I couldn't make the promise more real to him.*

Clark somehow grabbed her hand and squeezed it weakly. But there was nothing weak in the gaze he fixed on her. "Don't you remember what we started all this for? Do you want it to lead anywhere? Or are you willing to just let it collapse into chaos?"

She was silent for a long time. "No," she whispered at last. "I don't want that." She smoothed her feelings as well as she could, suppressing what she must—for now. "If that's the alternative," she said stiffly, straightening up, "we'll cover for you. But it's the last thing I can promise you."

She stood up.

Minutes later, the quakes started.

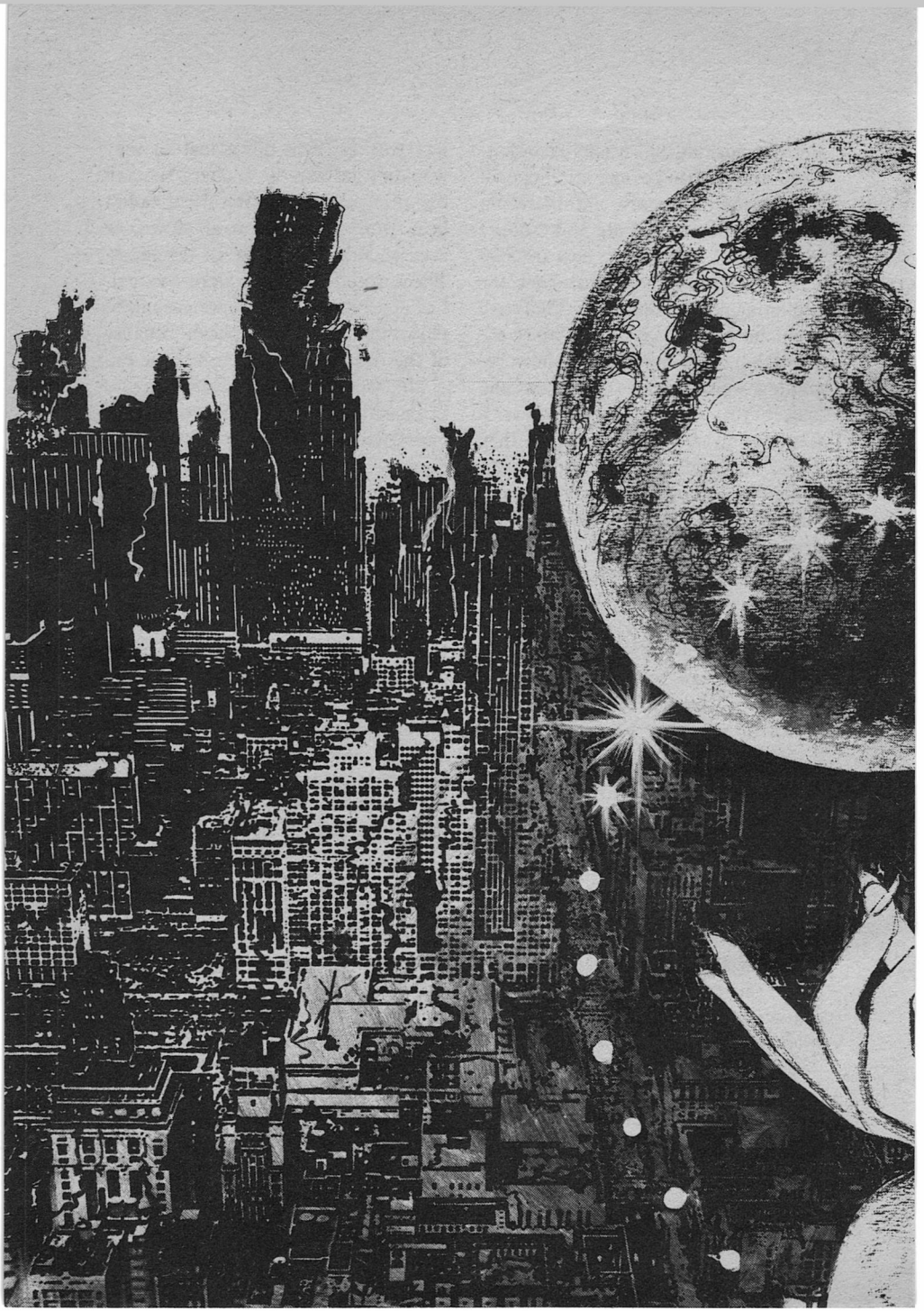
The new quakes were not the ter-

rific convulsions that would have shattered the Earth beyond all hope of even temporary repair, had the Kyyra not taken their elaborate and esoteric precautions. Mostly, the new tremors were less severe than those near the beginning of the trip, before the Earth could be properly girded against acceleration. But the changes now beginning were by far the largest and fastest yet. Even with the Kyyra's seeming miracles of preparation, they would be felt throughout the months of build-up. Though properly prepared buildings and underground dwellings would suffer little damage, their occupants would hardly feel secure with their china rattling in their closets for all that time.

And improperly prepared buildings, or vehicles caught out in the open, would not fare so well. They would perish as so many had at the trip's beginning, and sometimes in ways still worse. As the acceleration rose to levels approaching half a gee, the ground everywhere would tilt more and more steeply to the south. Until now, the apparent tilt had been unobtrusive; in the weeks to come, it would become obvious and then awesome. To the perils of earthquakes would be added those of landslides on an unprecedented scale. Tall buildings (where such remained), even mountains, would topple southward with thunderous groans. In places like Manhattan, cannibal crews during the preceding years had dismantled many skyscrapers, sometimes carefully picking them apart for recyclables, sometimes just getting them down fast so they wouldn't destroy the shelters beneath by falling all at once. But there hadn't been time to get them all down, or even to fully reinforce all dwellings. There would be—there were—casualties. There were even more casualties than there should have been, because of the day-early start. And panic out of all proportion to the actual increase in casualties, simply because people hadn't been expecting it for almost a day.

And violence, from casual rioting in towns to deliberate, savage, but futile attacks on Kyyra control stations.

Sandy and Jonel did all they had promised. They led the publicity campaign, personally broadcasting around the clock, pausing only for brief naps, quelling panic, explaining that the early start was a desperate measure made necessary by a plot to subvert all that the last twenty years had worked toward. They used every trick they could to rally popular support once more behind the plan; so highly charged was the public mood that nothing less would work. They painted the assassin as black as they could, while hiding both his identity and the much more complex feelings they really had about him. "Who," Sandy challenged in a typical speech, "could possibly support an opposition that would stoop to brutal, craven physical assault on a defenseless octogenarian? And not just any octogenarian, but one who for a quarter of a century has given his body and soul to saving mankind from destruction?"



Unseen crowds cheered. And every word tore her apart.

But it worked. Initially, even with its essential goal snatched irretrievably away, the Movement lashed out with no-holds-barred counter-propaganda, including vehement but unproved allegations that the assassin had been Jonel and Sandy's son. Without dignifying the claims with a direct answer, they turned them back against the Movement by citing them as further examples of how low Moses' followers would stoop. They outplayed the revolutionaries at their own game. Moses had nothing to match sympathy and indignation for a properly-described old man attacked by a young. In short order, his Movement was driven farther underground than it had been for months.

When Clark emerged from obscurity into public view at the end of the second day, he emerged in glory. Support for what was happening, determination to make it work, was at an unprecedented fever pitch.

And Caesar Clark was closer to godhood than any man had been before. Someone, somewhere, might still have dared to doubt that.

But no one, at that point, would have dared to say so, not aloud anyway.

Alycia, too young to remember the original quakes, was one who panicked at the unannounced onset. She told Sandy, when she finally reached her fourteen hours later, that she had tried to call her as soon as she felt the first tremor, and kept trying, with steadily growing tension, every fifteen minutes thereafter. She was on the verge of hysteria when she finally got through. "It just keeps shaking!" she moaned. "Won't it ever stop?"

"Yes, it'll stop," Sandy assured her gently. "But not for several weeks. We've known that all along. It won't hurt you, Alycia. This is what we've been ready for. You'll get used to it. Try to relax."

But Alycia couldn't relax. The following morning Sandy went to see her for an hour, to try to comfort her. She didn't look good. Her eyes were red, her fingernails ragged. The news that her brother-in-law had died violently, under vague circumstances which Sandy obviously didn't want to discuss, did not help her spirits. Sandy didn't tell her that Roberta had disappeared right after Greg's death, and investigators had found evidence that her whole relationship with him had been a subtle scheme to lure him into the revolution.

Sandy, despite the strain she and Jonel were under, invited Alycia to move in with them until Scott got home. She refused. She'd be a burden, she said. Besides, she'd been trying repeatedly to get a 'gram through to Scott and find out if he was all right, and she had to wait here until she got an acknowledgment.

I've been wondering about that myself, Sandy thought as she left Alycia crying softly to herself.

But she'd long since learned not to let such wonderings drive her to Aly-

cia's present condition. She'd had to. It was the only way to survive.

If only Alycia could learn that . . .

In the middle of the night after the second day, Sandy's phone shrieked at her until she answered it. Alycia's voice was full of terror and anguish. "Sandy," she gasped, "can you come here right away? I think the baby's coming!"

Sandy's mind snapped instantly to full alertness. *It's too early,* she thought. *It's much too early.*

She went right away, without bothering to dress, and she took Jonel with her.

The first tremors hit the station during Scott's shift, and kept going. Nothing of significance fell down right away, but during the hours Scott spent on the crazily swaying framework, he felt sure things were weakening. And still Mamani did nothing to the barracks—except make his workers try to sleep in them. He did make sure they heard a comnet explanation of the plot and counterplot, the assassination attempt, the reason for the early start. Scott knew enough about what was behind it to believe it, after allowance for poetic license. And he knew that, in most places, the one extra day wouldn't have made much difference.

But here . . .

It took almost a day to shake things loose enough to produce disaster. Scott was lucky: his building was undamaged. The first collapse occurred next door, near the end of his sleep shift. He wasn't sleeping well, and he heard the first rumble, transmitted through the ground, before the barracks siren drowned it out. Lights came on; the room full of nominally sleeping men exploded into a flurry of activity as they sprang from their beds, confused, and fumbled for suits and masks.

Outside, and in the building where Scott spent most of the day, it was quieter. The siren there was stuck on for over an hour, but the holes in the roof and walls left little air to carry sound. As he walked among the jumbled cots, or surveyed them from above, he sometimes imagined he smelled the smell of death. He didn't, of course—but the scene was so reminiscent of his nightmarish days of cannibal crew duty that his imagination supplied the detail automatically. In ways, this was worse. The bodies sprawled on and among these cots were acquaintances of his. Not friends—he'd had no friends here—but people he'd known when they were alive, people who should still be alive. Some of them were, moaning through breather masks, waiting with forced patience for help.

Scott was too dazed to think much about what he was doing, but he did it fast and well, almost automatically. And meanwhile the conscious part of his mind went over and over what had happened, trying to understand. Perched on the ragged edge of a hole, looking out at the stars and the unscathed latticework of the station, he felt the building still quivering, but

the worst seemed to be over. But now what? The barracks would have to be reinforced, just as Scott had so often tried to tell Mamani. But now they would first have to be rebuilt—and all of it would have to be done under the added handicap of tremors and growing acceleration. And the quite unnecessary loss of dozens of men.

How could Mamani be so stupid?

Could he, Scott wondered suddenly, have been in on the conspiracy? Had he wanted *this to happen?*

All through the day, as he worked, he pondered, and his anger grew. Several times he found himself thinking of Alycia, hoping she was all right. No reason why she shouldn't be, *he told himself stubbornly.* I'm sure they had everything ready there.

The thought of getting back to her, he began to realize, was almost the only thing keeping him going now. It occurred to him late in the day, as he applied the final outer seal to the second last patch in the roof, that with this setback, by the time he made it back he'd have a son or daughter to welcome him too.

He paused and looked up at the Milky Way, momentarily feeling better. It'll be worth waiting for, *he thought, with a defiant smile in the direction of Sagittarius.*

Physically and emotionally exhausted at the end of the overlong day, he stopped on the way into quarters to see if there were any radiograms. There was one, but his throat went dry and his world wavered as he read it.

ARE YOU OK? GREG DIED IN BUILDUP. ALYCIA DELIVERED EARLY. PROBABLY COULD HAVE SAVED BABY WITH INCUBATOR, BUT NONE AVAILABLE. ALYCIA OK BUT GLUM. SENDS HER LOVE, PROMISES MESSAGE WHEN FEELS BETTER. OUR LOVE AND DEEP SYMPATHY.

—MOM AND DAD

A worldwide tragedy is inherently too big for a single human mind to grasp or respond to. One frail girl losing her first child, one idealistic young man drawn into a conspiracy and shot down, one old and valued friendship turned to ice—any of those is another matter entirely.

A month afterward, they all still troubled Clark. He felt personally responsible. And now he kept wondering. At the most inopportune times—in the middle of a conversation, or halfway through a pile of paperwork—he would find himself staring vacantly into space, reliving the day the buildup began, asking himself, *Was it really necessary? Or could I have found another way?*

He would never know, of course. But that didn't stop him from asking, over and over.

And that wasn't good, because there was still a great deal to do. He and his wife Dianne had long discussions about it. She kept telling him he mustn't let the incidents keep bothering him, that he must get them out of

his mind and get on with today's business. He told her that he already knew that, and she'd be a lot more help if she could tell him *how* to take the advice he already agreed with.

He was staring and questioning now, with a pile of urgent reports only half done on the desk in front of him. Dianne, standing just uphill from the desk, smiled down at him. "Don't you have work to do?" she asked gently.

But Dianne had been dead for a quarter of a century. "You," Clark said gruffly, crooking a finger at her, "are a hallucination."

"Oh," she said, crestfallen. "I'm sorry."

She vanished.

The reports didn't. *A hallucination,* Clark thought. *Not a good sign.* He'd welcomed Dianne when she returned to his dreams at the end of the first year of the trip. In his dreams, she soothed him; she helped him sort out his most troublesome thoughts. She gave him the reassurance he so desperately needed, that what he was doing was worthwhile and maybe on the right track.

In that capacity he'd been grateful for her, and she'd been with him, off and on, for much of the trip—sometimes old, sometimes young.

But lately she'd overstepped her bounds. He sometimes imagined that he saw her when he was awake.

Always young. Always about Alycia's age.

So far he'd always consciously recognized her as a hallucination—a symbolic embodiment of things he needed. That gave hope that his mind was not too far gone. But he did see her, during the day. That was a sure sign that he was slipping.

A symptom, he thought wryly, *of*

In times to come

● It was inevitable that Captain Schuster, the hard-driving, no-nonsense hero of Sam Nicholson's stories, would eventually leave the sea and head for outer space. After all, Schuster's just the kind of straw boss we need to oversee the first space industrial developments, right?

Nicholson's "Actions Speak Louder" leads off our first 1978 issue. The January cover is by veteran Alex Schomburg, one of the bestknown SF illustrators in the nation, but a newcomer to Analog.

Margaret Silbar's science fact article discusses the possibilities of producing superheavy elements—*'way* beyond uranium—in the laboratory, and what such new elements could mean to us.

And Stanley Schmidt concludes his "Fugitive Earth" series with "The Promised Land," All in our January issue, together with more stories and our usual features.

senility creeping up on him.

He lowered his eyes to stare at the top report. They didn't want to focus. *Senility,* he repeated slowly, letting it sink in. *Maybe it's time I did something about it.*

Several times in the last few days he'd thought about stepping down, putting his burden on younger shoulders. But always there was one more thing that he had to take care of personally, or a resurgence of the belief that he was feeling better . . .

Or that awkward obstacle that had plagued him ever since Greg's death.

Well, he thought, *I did something about that, didn't I? Just a few days ago.*

Was it enough? Maybe I should check the new letter again, and decide. If I'm satisfied, I'll turn it over. If I'm not . . .

I'll fix it. Maybe I'll even talk to them. I'll try to convince them.

It's time.

The decision made, he stood up. That was no trivial undertaking. The acceleration build-up so far made him feel as if he'd gained over ten pounds in the last month, and in the same time he suspected he'd also lost more strength than in any comparable period before. He grasped the handles he'd had installed on the desk, strained and groaned, and wound up "vertical." Then, carefully (for his ankle was healing slowly), he inched along the edge of the desk to the handrail at the left.

The handrails were necessary, as were the heavy east-west ridges—not quite steps—covering the floor to improve traction. Nine or ten degrees of tilt is a lot steeper than a spry young person who hasn't thought about it might imagine. *And,* Clark thought as he stepped off the cradled platform that held the desk and chair apparent-horizontal and started dragging himself up the rail toward the filing cabinets against the north wall, *it's going to get a lot worse. Both the tilt and the weight.*

It was slow going. He took his time, stopping to catch his breath when necessary. *Should have listened to myself,* he thought, *when I told myself to get more exercise.*

Well . . . too late now.

The recurrent thoughts about Alycia and Greg and Sandy returned, unbidden and unwelcome. *Was it necessary?* he asked himself for the hundredth time. But now he went farther. He thought of all he'd done, all the way back to the time when he told the Kyyra to go ahead and start moving the Earth. *Was any of it necessary? Or right? Are circumstances ever special enough to justify the things I did?*

I don't know. I'm just not sure.

Too late to do anything about it, he became aware of messages coming in from several senses telling him he was losing both his balance and his grip on the handrail. There was a dull pain in his chest, but that, like everything, seemed oddly distant and lazy and dreamlike. He watched with little more than curiosity as the corner of the desk rose slowly toward his head.

I tried, he thought simply.

And then the corner of the desk arrived and consciousness left.

Sandy did not make her decision lightly. Jonel never came to agree with her, despite frequent long discussions, but in the month of soul-searching and nightmares that followed Greg's death and Alycia's miscarriage, she grew more and more convinced that it was necessary. It was not, she kept telling herself, that she no longer supported the trip's goal. It was, rather, that her emotions about things actually done so far would make her unable to contribute effectively.

Do I really believe that? she wondered occasionally. *Or am I rationalizing?*

I believe it, I think. A clean break would be best for everybody.

She finally nerved herself to tell Clark. But she got no answer when she tried to phone him. When there was still no response a half hour later, she began to feel edgy. This was going to be hard enough without the irritation of repeating calls never answered.

Four more times she tried, in half that many hours. Gradually, the irritation changed to apprehension. Normally, Henry answered promptly, and he seldom left his office.

Reluctantly, she left her apartment and went through the tunnels to his. He didn't answer his door, either, and it was locked. But Sandy still had a key.

She found him where he'd fallen, head down across the floor ridges by the desk, motionless. Something cold settled in her stomach. "Henry!" she gasped as she hurried to his side. As she examined the bump on his head and checked for pulse and other vital signs, she was vaguely embarrassed that her dominant emotion was frustration and annoyance at being too late to deliver her message. Enough memories came back from pre-Movement days to make her sure she should feel deep grief.

But the grief wouldn't come.

When she'd convinced herself there was nothing to do for Clark, she used his phone to call Jonel. He was there a few minutes later. They covered Clark with a sheet until he could be buried (such as it was) in the recycling plant. Then Jonel said, "I guess we'd better check that file."

Sandy nodded numbly, teeth resting lightly on her lower lip. "This is what I was coming to avoid, Jonel," she told him as they climbed the floor to the north wall. "I'm sorry; I know you didn't agree. But I had to. I was going to tell him to leave me out of the succession arrangements." *Partly,* she thought, *because it was my last semiofficial connection with the government and Caesar Clark.*

And partly because I was afraid of where it was leading.

Jonel said nothing. He knelt to open the combination-locked file Clark had told them about, hidden in a false-fronted compartment at the back of one of the regular files. The paper on

top was conspicuously addressed to him and Sandy, in Clark's hand, with the words "personal and confidential" added under the names. *I've seen that before,* Sandy thought with a sudden tightness.

The sense of *déjà vu* persisted as Jonel sat down on the sloping floor to open the envelope and she leaned on his shoulder to read. The single hand-written sheet he unfolded was uncannily reminiscent of one Clark had had hand-delivered to them over twenty years ago, desperately asking for their help right after the trip's violent beginning. It was written in a hand that was little changed, except for a little more shakiness that came with age.

And it began the same way, though it was dated just three days ago.

Dear Jonel and Sandy,

I hope you've managed to forgive me enough by now to read this and do what I ask. I know it won't be easy after what's happened—especially for you, Sandy. But there's really no one else I'd trust with it.

So I'm asking you. Just one small favor: Finish what I started. Take them home.

Please.

You shouldn't be surprised; you must have expected this. I've never bothered you with titles or such official claptrap, but you know you've been my closest and best and most important advisors for years. You know more about the total situation and strategy than anybody else now alive. You're a good team, and the public already knows you both.

The official claptrap will be necessary now, of course. The world will need to know that you're in charge—and don't let them forget it. You'll find detailed instructions here to get you started and fill in gaps in your knowledge. I've made arrangements to get you legitimized and recognized; all you have to do is activate them.

One more thing: it's not going to be easy. You already know that, but it may be even harder than you now realize. Expect it. Don't let it crush you. You'll have to do things you don't like. Try to remember some of the good advice you've given me about those.

Moses' Movement isn't dead—only waiting. We kept them from stopping the build-up, and drove them into hiding, but that's only strengthened their resentment and determination to get rid of us. You'll hear from them again, if only at the end. Don't underestimate them.

I hope I haven't scared you off—but I doubt that. If you honestly think somebody else can do it better, let them—but you'll have to find them. It's your problem now.

Thanks and good luck,
Henry

Her throat felt dry and her pulse raced as she finished reading. "That's what I was afraid of," she whispered. "I can't do it, Jonel. Not after all that's happened."

"We've been all through this, San-

dy," Jonel said quietly. "If you can't, who can?"

"I don't know. I told you you should go ahead, if he asked us and you wanted to—"

Jonel shook his head. "You know I can't do it alone. We're a team, Sandy. I know some of the problems, but mostly just the technical ones. I can't talk to Kyyra like you can. Or our own people, for that matter."

"You can find somebody else—"

"There isn't anybody else. Not with our background."

"I know." She bit her lip, wishing he wouldn't make this so hard. "I don't know what to tell you, Jonel. It's not that I don't want to, exactly. I've tried to understand, but after the last month . . . I just can't function well in this state. The less I have to do with the government, the better. That's what I was going to tell Henry."

"A cop-out," Jonel grunted. He looked straight at her. "You know that's not you, Sandy. When something has to be done, you can do it. Your feelings might make it hard or painful, but you overcome that like any other obstacle. Henry did it for over twenty years. How do you think he felt about some of the things he had to do? How do you think he felt about Greg and Alycia? You can't understand—"

"Can't I? How do you think I felt telling those vicious lies about Greg? Later, when I had time to think, I saw that we didn't have to do it that way. We could have been honest. But we didn't have time to see the ways."

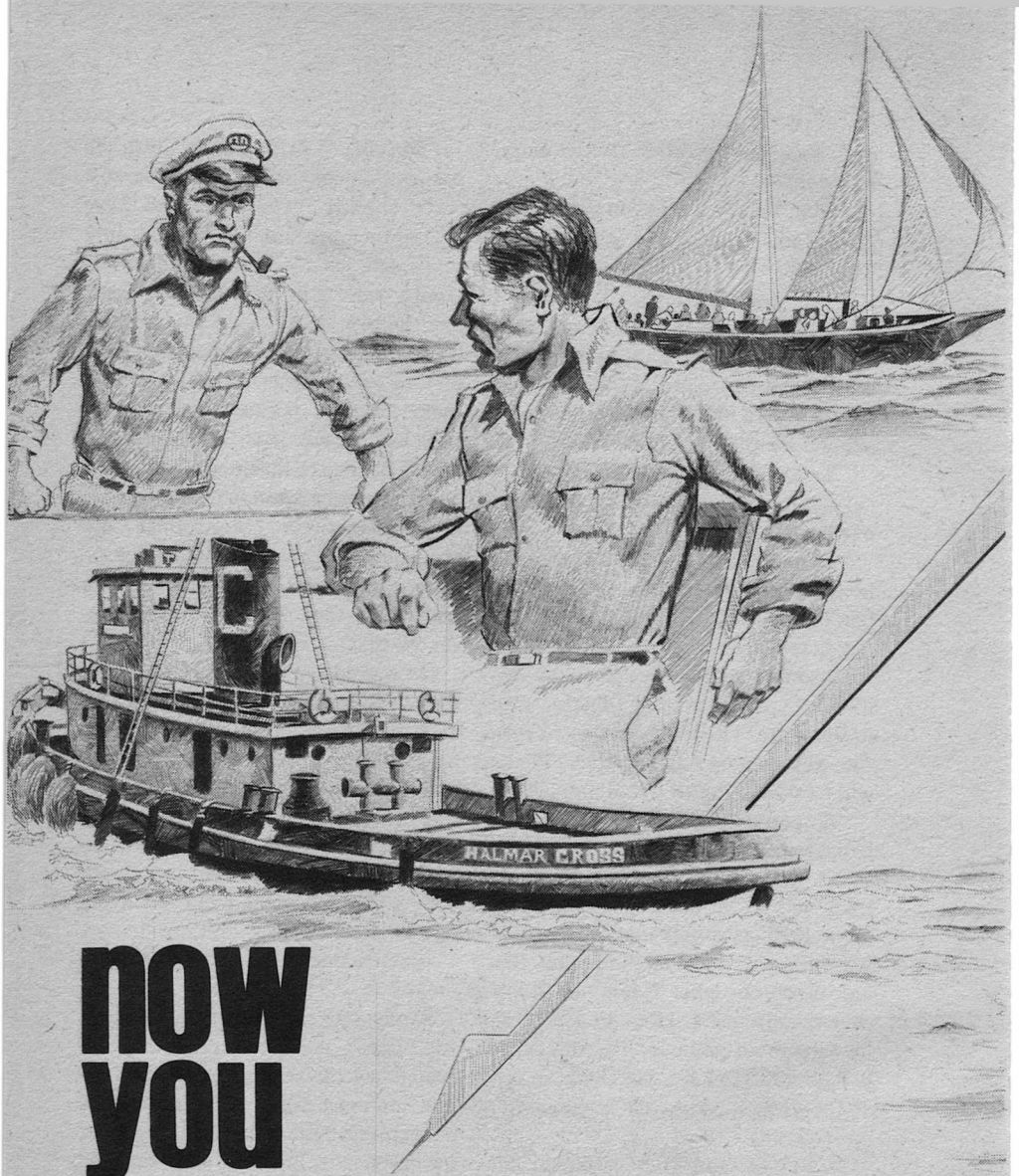
"Maybe," said Jonel, but he sounded unconvinced. His tone softened slightly. "Okay. So you have begun to understand. Are you sure that's not what you're afraid of? If Henry could talk, he'd tell you that's just the beginning. We'll have to do a lot of things in the next decade that'll torture our consciences. But we'll do them anyway, because the alternatives look worse. If we do them, we'll have a chance of finishing what we set out to do when we left the sun. If we don't—they might not get done, and everything it's already cost us will be wasted. And we'll have to live with the knowledge that we might have prevented that."

He waited. Sandy stared for a long time at the white-sheeted form by the desk, feeling a glimmer of renewed respect—and sorrow that it was too late to tell him. More than ever before she understood what he'd been through, and the burden she'd be assuming if she did what he asked. Very softly, she said, "He left a big pair of shoes to fill, didn't he?"

Jonel nodded. "But he grew into them."

Sandy was silent a little longer. It still wasn't easy, but gradually she beat down the resistance to the decision she must make—and as the new burden settled onto her, another seemed to lift. "So will we," she said at last. "But someday, Jonel, I'm going to tell them the truth about Greg."

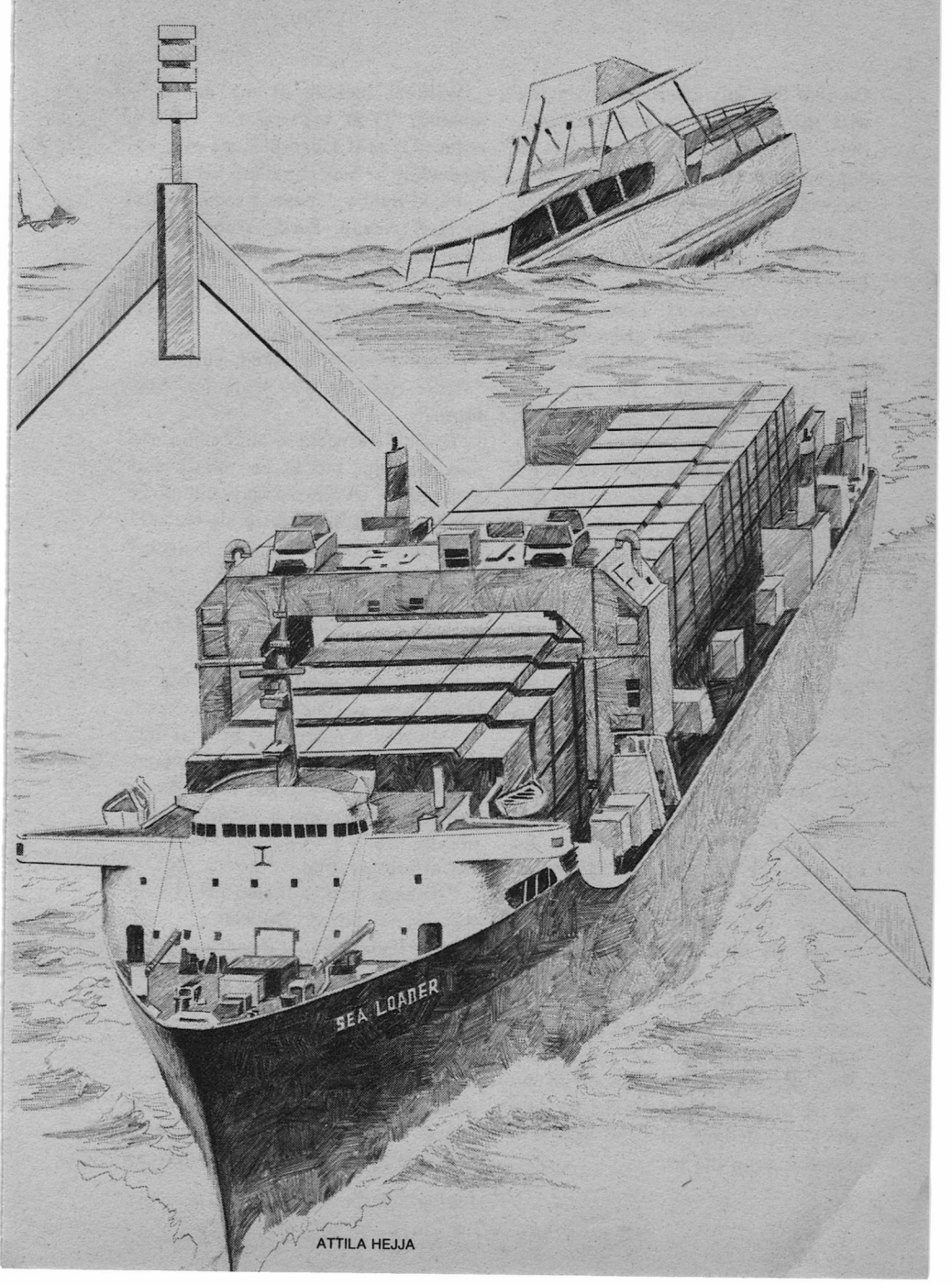
Together, they started through the file. They had a lot to do. ■



now you see her

"Blessed are those
who believe without seeing . . ."

Sam Nicholson



ATTILA HEJJA

On that hot July afternoon, swinging with the Gulf Stream past Hatteras, the bulk carrier *Sea Loader* was in dangerous water, but my much-advertised troubleshooting sixth sense never let out a yip.

The *Sea Loader* was bound for Perth Amboy with a cargo of copper slag from Venezuela. I was skipper aboard because I had given Mickleberry in Operations some advice he had taken, for once. The previous skipper had been an old ditherer named Hibbard, half-sick from a nervous stomach and unequal to the job. I told Mickleberry to pension the guy off before he made a mistake that would cost the Company real dough.

After the *Sea Loader* had been involved in a harbor collision while Hibbard was in his bunk, Mickleberry took my advice, eased the guy out and sent me aboard to tighten up the sloppiness that results when the top man is not minding the store.

That afternoon, as the bridge watch was changing at 1600 hours, the *Sea Loader's* chief engineer ambled onto the bridge wing, coming topside for air after his daily siesta. He was a pipe-smoking bookworm named Buchanan. I had nothing against him except his indifferent cold-fish attitude.

On that afternoon he seemed to have turned out like a bear with a sore head. He gave me a curt nod, grated his pipe stem to the corner of his mouth and rested a tattooed forearm along the dodger. His heavy eyelids raised to scan the sea.

Without looking at me he commented, "You ordered the RPM's reduced," as if I had put one over on him while he was pounding his ear.

I said mildly, "Yeah, I reduced her to Half Ahead. Perth Amboy don't want us before noon tomorrow."

He chewed his pipe stem and made another comment. "I don't see the coast. We must be way out."

"Out where?" I asked, surprised. "We're right on the beam for Ambrose."

This did not seem to satisfy him. He took the pipe out of his mouth and explained, "Hibbard always cut along the coast, north of Hatteras. He said it helped him keep his bearings straight."

"Hibbard never stepped up to bat without making sure nobody had stolen the base paths."

Cold humor gleamed in the heavy-lidded eyes, and the waxy lips quirked. It suddenly occurred to me that Buchanan really disliked me very much.

"Always expect to bat a thousand, Schuster? Carrying a rabbit's foot? Maybe that's a troubleshooter's first law of preservation."

"Nobody bats a thousand," I said shortly. I noted Buchanan's odd mood. His face had a tense pallor, the eye pouches faded to greenish white.

He clamped his teeth on the pipe again, gave me another curt nod, and ambled into the wheelhouse. I saw him head for the chartroom. He generally took a once-a-day gander at our course and position, but I wondered why the final leg of the voyage had

any interest for him. He could not get to Perth Amboy faster than the ship.

He retired below after a short session in the chartroom. I went to my quarters to line up my Voyage Report. Paperwork not being my strong point, I decided to take a break around 1630 hours and see if I could catch a news report from some coastal radio station.

I caught it, all right.

". . . yachtsman allegedly run down at three o'clock this afternoon by the bulk carrier *Sea Loader* five miles off Cape Henry. Donald Claremont, aged 42 from Virginia Beach, was repairing the motor aboard his 30-foot cabin cruiser *Amelia* when the 20-thousand-ton ship allegedly ran him down, throwing him into the water and sinking the cruiser. The badly-shaken yachtsman was picked up immediately by the tugboat *Halmar Cross,* which had witnessed the incident. The *Sea Loader's* owners have no comment, aside from stating they have no ships in the Cape Henry area. Coast Guard sources say the *Sea Loader* is due in Perth Amboy tomorrow noon."

Well, it really zonked me. At 3:00 PM we had been a good hundred and fifty miles eastwards of Cape Henry, and we sure had not run down any cabin cruisers. The incident was a damned lie. The tugboat *Halmar Cross* could not possibly have witnessed it. I knew the *Cross* line of tugs. A hardbitten, no-nonsense bunch.

What the devil would I be doing, up under the coast? As long as there was a northward boost to be sneaked from the rim of the Gulf Stream, I was staying with it. I was no Hibbard, who got nervous prostration unless he could keep one foot glued to home base.

Hibbard. Yeah, that rang a bell. Buchanan had expected me to use Hibbard's course lines. He had expected the ship to hug the coast north of Hatteras and be in sight of land at 1600 hours. Blue water from horizon to horizon had drained the blood right out of him.

The radio officer knocked at the opened door and handed me a message from Mickleberry. I reflected that Mickleberry's ulcers had been through a bad hour and a half.

The message was: RECONFIRM NOON POSITION SUBSEQUENT COURSE

A reasonable request, everything considered. I went to the chartroom. The chief mate was taking our 1630 bearings from the radio navigation unit. He scribbled the final figure and moved aside to let me at the chart table.

A pair of dividers lay open on the chart.

Now, although there was no law about it, the mates usually closed the dividers and returned them to the long tray at the back of the chart table. Since the mate had only now jotted down the bearings, he probably had not been measuring distance on the chart. But I asked anyhow, "You been using these dividers?"

"Why, no—not yet, Captain," he returned, puzzled.

"Who's been in here since the position was marked at 1600?"

He hesitated. "I saw Buchanan. Somebody else could have ducked in here while I was on the bridge, but—"

I picked up the dividers carefully, put one point on Cape Henry and swung an arc. It went through our course line as near to our 1500 position as I would expect a chief engineer to come.

Without commenting, I rechecked our noon position and course. I returned the dividers to the chart tray and said to the mate,

"The heat wave must be scrambling the wire services. They got us running down a cabin cruiser off Cape Henry."

"Cape Henry!" The mate pushed his cap off his forehead. "Sounds like a stunt Hibbard might have pulled. He always made a beeline for Hatteras and steamed hell-for-leather up the coast." He gestured to Hibbard's erased course lines, still visible on the much-used chart. "Hibbard burned up a lot of bunkers, racing around that dogleg to Ambrose."

I left the chartroom and went to my office. There was no ignoring the connection between Hibbard's usual return route and the incident off Cape Henry. The lie must be a deliberate attempt to discredit the ship. A planned fraud? A hit-and-run insurance swindle?

But how did Buchanan fit into it? The more I thought about his tense, sarcastic attitude on the bridge, the more I was convinced he had known that the Cape Henry incident was due to occur.

I wrote the message to Mickleberry and took it across the alleyway to the radioroom. As I handed it over, I asked the spark, "Anybody aboard had messages or phone calls I don't know about?"

His honest surprise could not be doubted. "No, there's been nothing, Captain."

I went back to my office and thought some more about Buchanan. Apparently he had not sent our Perth Amboy ETA to the plotters. But then, nobody needed to get the ETA from the ship. All they needed to do was to call up the charterer's agent and ask.

The agent had known about our noon arrival long before the information had been finalized and sent aboard.

Was Buchanan really framing a hit-and-run damage suit against his employers? I had not thought he was such a fathead. Aside from anything else, he must have known that squeezing even legal payments out of the Company was like getting juice from a pet rock. Trying a fraud on them would be like tangling with the *Sea Loader's* twin screws.

Well then, I figured, let's put it another way. Buchanan was no dummy. If he was trying a shakedown, he knew it would work. Therefore, most probably, it had worked before. Like, a yachtsman reports being run down by a ship—most likely from a small

foreign company. Having lined up witnesses, the gang sues the ship's owners, and if the ship has been in the immediate vicinity, the owners pay up rather than drag out legal costs or have US waters closed to them. A small Scandinavian or Dutch company would not have the means to investigate perjured testimony.

I had built up quite a case, but it fell apart at that point. The newscast had said the Cape Henry incident had been witnessed by the *Halmar Cross*. None of the *Cross* tugs would be involved in fraud.

I needed more facts. I saw that a 1700 hours bulletin was about due, so I tried the radio again.

". . . captain of the tugboat *Halmar Cross* stated there was no doubt that the cabin cruiser was run down by the bulkship *Sea Loader*. He told reporters that he had berthed the bulkship several times and recognized her in detail."

I was zonked again. The radio was continuing,

". . . account was corroborated by the steel tycoon George Festerman, whose yacht *Trident* was also at the scene. 'The ship crossed our bows after running down the cruiser and proceeded at Full Speed. Her name was clearly visible in our binoculars and there was no doubt of her identity,' said Festerman. The Coast Guard is withholding any statement until the *Sea Loader* arrives at Perth Amboy."

Yeah, the Coast Guard must be doing some head-scratching as they reviewed our noon positions. They knew I could not possibly have been five miles off Cape Henry, but like me they did not doubt the integrity of the *Halmar Cross* or of George Festerman, steel tycoon.

What, actually, had these unimpeachable witnesses seen? Not a real ship. That was absolutely out of the question—because of the astronomical expense to the swindlers, if nothing else.

The whole fraud revolved around a gimmick, and it must be so foolproof that it did not need perjured testimony. Still, if it had been used before, it must have left a trace somewhere.

I coded a message to Mickleberry: INVESTIGATE SHIP-YACHT INSURANCE PAYOFFS MIDDLE ATLANTIC STATES. It was late in the day to catch Mickleberry at the office, but I figured he would be hanging over his Telex until the uncertainty was cleared up.

It only got worse. The news item might have died a natural death, since it could be only of local interest, but the skipper of a charter schooner apparently saw a way to get some free advertising. At 1730 hours the following bulletin had been added,

". . . charter schooner *Gold Ness* reports having sighted the bulkship *Sea Loader* one hundred and fifty miles east north east of Cape Henry at three o'clock this afternoon, the exact time at which the bulkship allegedly was running down the cabin cruiser *Amelia* only five miles off the cape. The schooner skipper radioed this sta-

tion that all his ten passengers were on the deck of the *Gold Ness,* which charters tourist cruises to Bermuda and the Bahamas, when the *Sea Loader* crossed astern . . ."

I remembered meeting the *Gold Ness,* a neat little schooner under full sail, with the light westerly wind giving her a boost toward Bermuda despite the contrary current. I had altered course to go well astern of the schooner, so that our bow wave would not swamp her—a courtesy the skipper apparently had noted in his logbook, since fewer and fewer Masters Of Steam have any understanding of Sail.

The radio station was fading out, so I fiddled with the megahertz until I remembered that our supper would now be under way and unless I legged it down there I would find nothing left but bread and salami.

I went below to the officers' mess room. Supper had come and gone, and all the places were cleared except mine at the head of the table and Buchanan's at my right hand.

I turned off the mess-room radio, which was squawking static, and took my place. As the messman was slinging a hot platter of hashed browns and fried eggs in front of me, Buchanan came into the room.

He paused a fraction of a second, then transferred his cold pipe from his mouth to his pocket and seated himself as usual. When the messman had gone back to the pantry I did something I usually do not do aboard—touch upon personal conflicts. As I helped myself to the platter, I said,

"Whenever a guy hates my guts, I generally know the reason for it, but I'm damned if I can figure out why you dislike me, Buchanan."

He poured himself a cup of coffee. "Nothing personal, Schuster. General resentment, I suppose, that any man gets to the top in an organization without conscious effort."

"You mean, I got where I am by bull luck?"

"No. That's the most irritating part," said Buchanan, giving me a heavy appraising glance. "Luck is nothing to resent. It's just—luck. Nobody detests a man for beating the odds at the dog track. It's when luck changes to destiny that it becomes something to resent."

"I don't follow you."

"Luck evens out. It doesn't pick favorites. Lucky today, unlucky tomorrow. Chance is blind—like justice," he added, his eyelids dropping lower.

"But destiny is whimsical," he resumed. "Destiny takes a man like you, Schuster—a man with no special talent except a dogged capacity for work—and loads the dice. The difference between you and a dozen smarter men in the Company is that you are always in the right place at the right time. You become a man who cannot do anything wrong."

"I oughtta introduce you to Mickleberry."

He waved this aside. "Oh, I've heard Mickleberry sounding off about you. About your rough manner, your

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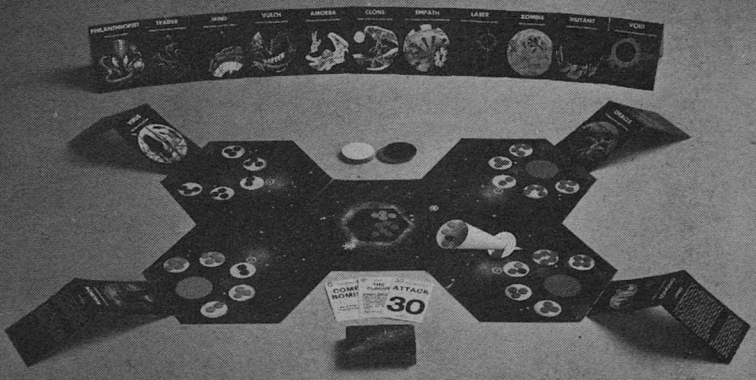

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loud mouth, your damn-the-torpedoes attitude. Mickleberry has to fire you once a year to give his ulcers a rest. But when you tell him something, he listens. For example, why are you aboard the *Sea Loader* at this moment?"

I did not answer, and he went on, "Because you stuck a knife in Hibbard's back. The old guy was sick and just serving time until his pension. You had Mickleberry kick him out and put you aboard."

I gave Buchanan a heavy look of my own. "Yeah, me being aboard kinda queered your Cape Henry caper, didn't it?"

"Believe it or not," Buchanan said patiently, "my irritation stems entirely from impersonal resentment about those loaded dice. Once again you seem to be the right man at the right place. You are still batting a thousand. For that reason and no other, I hate your guts."

I believed him. The bookish intellectual type gets hot under the collar about general principles more than personal ups and downs.

The messman came back with a refill on the bread, so we knocked off the conversation and I stoked up on the calories. Buchanan did not have much appetite. Sometimes I had the same effect on Mickleberry.

I do not know how the news coverage would have gone if another more important story had broken. But it was midsummer, the politicians were at the beach, and nobody was hijacking planes, so the whereabouts of the *Sea Loader* became of intense interest to the news bureaus.

The crux of the matter was that the *Halmar Cross* and the Festerman yacht *Trident* were sticking to their guns about seeing the real bulkship *Sea Loader*.

For me, the significant item was the steadfastness of the skipper of the *Halmar Cross,* since he must have found out right away that Schuster and not Hibbard had been on the bridge. It was the first question he would ask either the Coast Guard or Mickleberry, since he knew the ship. The answer must have zonked him as much as his report had zonked me. If he was sticking to his guns, it was because he was honestly convinced he had seen us.

The gimmick! I had to figure it out, and the newscasts were only distracting me. "This looks like it's becoming one of the great sea mysteries," yapped one broadcaster, "comparable to the *Mary Celeste* and the disappearance of the steamer *Portland*. Where was the *Sea Loader* at three o'clock this afternoon? Off Cape Henry or a hundred and fifty miles at sea? How can a ship be in two places at once?"

He left the question open, which did not help me a lot. But at 2000 hours came the slipup I had been waiting for. The newscast played a taped statement from the dunked yachtsman Donald Claremont, who was (quote) resting comfortably despite what looked to be a crippling back injury (unquote):

"The *Sea Loader's* bow wave lifted

the *Amelia,* and as she heeled over I saw the ship's hull looming above me—black with rusty spots and a funny long dent over her port hawse-pipe."

It was true that we had such a dent from Hibbard's harbor collision. However, we would show no sign of having struck the cabin cruiser, and Donald Claremont was being very careful not to claim we had. It was the *bow wave* that had done the damage.

Legally the statement warmed the heart of an old sea lawyer like me, but it made the mistake I had been waiting for. Now I knew what question to ask the captain of the *Halmar Cross.* Now I could lower the boom on that well-read engineer, Mr. Buchanan.

To prove I could do things in an intellectual and civilized manner, I phoned his quarters and invited him up for a drink. He came, wedged himself in the settee corner, pipe in mouth, and opted for beer. I poured myself a slug of scotch, pulled up a chair and began,

"I've been thinking over the Cape Henry incident."

"Yes, it's certainly all over the radio dial," grimaced Buchanan around his pipe stem. "Claremont was lucky with witnesses—the *Halmar Cross,* especially. Kind of makes you the fall guy, doesn't it?"

"Well, now, the Coast Guard has the *Sea Loader's* course and noon positions since we left Venezuela. They know my course is nowhere near Cape Henry."

"And what is their evidence worth?" Buchanan took the pipe out of his mouth. "A civil damage suit is not a Coast Guard hearing. A civil jury believes eyewitnesses, not official documents or navigation figures they don't understand."

"As you know to your profit."

He took a slow drink of beer. I went on,

"I'm not trying to trap you with a bluff. I'll bet one thousand dollars—and you know I'm no welsher—that I can describe what you would call the *modus operandi.* Take me up on it?"

He considered a long moment. "No. I was betting that Donald Claremont would end your perfect record today. I won't throw good money after bad."

"Yet you must have known I would not follow Hibbard's course."

"Well, we assumed you would part company with the Gulf Stream in the general vicinity of Hatteras. Distance is really not all that important. You see, Schuster, a civil jury is oriented to land speeds. To them, a discrepancy of fifty miles is nothing. They can't comprehend that fifty miles could mean five hours steaming for a small freighter.

"One hundred and fifty miles is admittedly stretching the limits," he added, "and having that damned charter skipper poke his nose into the affair—! Destiny again."

"Not at all. The skipper of that schooner logged our meeting because I changed course when I could have plowed ahead and let our bow wave punch him in the nose. He phoned the

radio station to show me his appreciation by getting me off Donald Claremont's hook. It was my knowledge of Sail and my correct maneuvering that made the *Gold Ness* a factor."

Buchanan thought this over. "Yes, the *Gold Ness* can perhaps be credited to your dogged capacity for knowing your job. But when all is said and done, if Claremont brings suit the issue will boil down to the personal testimony of the two most technically impressive witnesses—you and the skipper of the *Halmar Cross.*"

"But it wasn't meant to be my testimony," I pointed out. "The plot was laid when Hibbard was skipper. With his indefensible courses, sloppy logbooks and the recent harbor collision, Hibbard could be torn apart before a jury.

"I'm no ready-made fall guy like Hibbard," I continued. "I run a tight ship and my record is clean as a whistle. This caper should have been aborted when I replaced Hibbard. That it was not aborted, Buchanan, would seem to indicate that personal spite overcame your normally good judgment. You had to take that chance of doing me dirt."

Buchanan sealed his lips over his pipe.

I went on, "Cockiness—the cool nerve of challenging the Company's legal powerhouse—was what first struck me about the caper. The fraud had what the swindlers believed to be an unbeatable gimmick—a duplicate ship that could make eyewitnesses swear to her on a stack of Bibles.

"But, you know, any con game, no matter how ingenious, works only against weakness. If this gimmick had worked over and over—as I was betting it had—then the victim-ships were carefully chosen. Badly-run ships, captains like Hibbard, drunken officers, other collisions against the ship's record. So, at least one member of the gang was in shipping."

Buchanan was watching me with ironic detachment. I continued,

"The difficulty is, a working officer does not get aboard the very large variety of ships that the scheme needs. After all, companies worth suing don't have all that many badly-run ships. So the man who cased the victims must have been a shipping agent who went aboard scores of ships in the normal course of his work. He spoke with the officers and could size up the conditions on board.

"Now, here's where I got the cart before the horse," I said, and Buchanan shifted his pipe. "I assumed that the agency man was the Master Criminal. But that could hardly have been the case. The fraud is nothing without the gimmick, and a ship's agent would have a hard time finding a scientist who would duplicate ships for him.

"So let's turn the picture around and say that a scientifically-inclined guy invented a way to duplicate sizable objects. Probably he can duplicate just about anything—Bedloe's Island, a diesel locomotive, the Taj Mahal. If he decides to duplicate ships, it's because he works on ships—with his scientific background, probably as

an engineer. It was the engineer who masterminded the fraud and found a shipping agent to help him.

"I'd suppose," I said conversationally, "a three-dimensional duplicator of that scope would be worth more on an honest market than used in an insurance swindle."

Buchanan snorted and took the pipe from his mouth. Dull color darkened his cheeks. "You know damned little about it, Schuster! Do you know what happens to an independent inventor today? The big corporations rob him blind! They reject his patent—and build the same thing themselves, using a staff of lawyers to invalidate his claim. Or they pay him a few hundred dollars plus royalties, with so many contract loopholes that they can make millions without giving him a cent.

"If an inventor has a new idea," Buchanan finished more calmly, "he had better make the millions any way he can—and to hell with being an honest sucker."

I wondered what patent deal had burned Buchanan so badly that he had decided to use his duplicator gimmick outside the law. I went on,

"When I came to think about the fake *Sea Loader,* a couple things were obvious. First, she could not be a solid ship. The whole fraud is based on the

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fact that only one *Sea Loader* exists. The ringer appears at the collision site and disappears immediately, leaving the real ship to take the rap.

"Next, the captain of the *Halmar Cross* said he recognized the details of the *Sea Loader*. The fake ship was the spitting image of the real. That implied photocopying. Something like a Xerox copy blown up three-dimensionally.

"When I got that far I realized I was trying to pin down an optical illusion. How could it be created out of thin air? Well, from a ship's bridge I see plenty of solid-looking illusions—rainbows, islands where no islands ever were. And, generally, nature's effects can be imitated.

"Especially in these days of films, slides, tapes. A few years ago, when I couldn't finagle myself out of the compulsory vacation the docs order now and then, I took a bus to Florida and moseyed around the tourist places. I saw the 360° movie screen at Disney World, where the audience is in the middle of the action.

"I remember it," I added parenthetically, "because in one scene we were standing on the forward deck of a ship. I could see the guys making ready the mooring lines on the focsle, and I could turn around and look up at the bridge. It was so real that I got the hell out of there, phoned Mickleberry and told him if he didn't put me on a ship soonest, I would sign aboard the first rustbucket that would take me.

"So the 360° screen stuck in my mind, and I thought of it in connection with the fake *Sea Loader*. Suppose the technique could be reversed. The movie is the 360° center and the audience is outside it."

Buchanan stirred. "But the spherical screen? On the open sea?"

"I think the gimmick uses the same screen that nature uses—waterladen atmosphere. Only, the water molecules have to be fogged."

"A time-consuming process, even for nature."

"Not necessarily. I remember a voyage through the Straits of Magellan, when a full hurricane hit us out of a clear blue sky. The wind whipped the sea and air together. In a few seconds—literally seconds, Buchanan—we were floating in a homogenized mist, a three-dimensional screen of shattered molecules.

"I don't know because I never tried it, but I believe a field of high-speed particles would break the sea atmosphere into the same screen of fog. On a hot summer day, the fog would continually evaporate upward, like the heat shimmer off an asphalted dock.

"So there's your hollow screen—cigar-shaped, probably, since a ship is much longer than she is high. The generating machinery could be very small in relation to the area covered. The difficulty, in fact, would be in keeping the electromagnetic activity from seriously disturbing radio and telephone communications within the entire horizon area.

"In the center of the three-dimensional fogged shell would be the tape

projectors, gimballed to keep the image steady at sea. They would throw a solid-looking copy of the ship on the insides of the screen. From the outside the projection would look like a solid ship, from any angle."

"Not with a cigar-bulge field," frowned Buchanan. "You'd get a projection like a Fun House mirror."

"Okay, okay. All I want to make clear is that the technique of the 360° screen could be applied from within to the vapor field, giving an image as sharp and valid as a rainbow." And I went on,

"Well, when the Master Scientist has the gimmick ready, the shipping agent starts casing likely ships. He could build up a file of descriptions and photos without knowing which ship will satisfy all conditions.

"Then he stalks the likelies through ordinary shipping channels. Eventually one of them is going to be due along the Continental Shelf during the midsummer yachting season. The scientist prepares the duplicator tapes from the photos, and the pair of swindlers start looking for a yachting stooge.

"Now, this scheme has implied a scientist and a shipping agent. It also implies a crooked lawyer for the courtroom work, and the lawyer now comes into the act. He looks through his pending bankruptcy files—at least, a bankrupt would be easiest to persuade—"

Buchanan's eyelids lifted a little, and he smiled.

"—until he finds a guy with a boat. If the guy also has an old whiplash or back injury, so much the better, but the important thing is that he really can handle small craft.

"The lawyer and the yachting stooge come to terms, the yacht is equipped with the necessary remote-control devices, the other gadgetry is loaded aboard a sturdy workboat—probably a rebuilt fishing trawler—and the plotters wait for the agent to pick up the victim's one dependable time-message—the 48-hour ETA required before arrival at an American port.

"From this ETA and the ship's position the swindlers plot on a chart the most convenient point—convenient from the aspect of traffic and water depth—that the victim will be passing in daylight. They move their two boats to a nearby marina and wait.

"During the next dark hours both boats go out to the chosen site, which will be far enough offshore to avoid most of the small boat traffic. From the trawler they assemble the long narrow pontoon raft that will hold the control machinery and the banks of gimballed projectors. They attach the gadgetry to the raft and add the outriggers that will generate the field screen."

Buchanan muttered around the pipe, "He even guessed the outriggers!"

"You don't give me credit for having a brain in my head, do you?" I demanded. "The field generators have to be outside the projector core, right?

Where else can they be, except on the outriggers?"

Buchanan shrugged, and I went on,

"Now, all this equipment has been built to withstand underwater pressures, so they anchor it and sink it with submerge-and-recall controls. A sea mile along a course parallel to the one the victim will be using, they anchor and submerge a homing base.

"They go back to the marina. A couple hours before the countdown the stooge takes the yacht out alone, finds the anchored units with his sensors and stations himself between them. Naturally his engine is working, since he can't let himself be carried away by wind or current.

"What he is waiting for is a clear sea in the area. He may have to wait an hour or so, though the shipping lanes are not as crowded as they used to be. When he is alone, he recalls the projector unit to the surface and switches on the field and the projector tapes. If the illusion is fuzzy, he can undoubtedly fine-tune it from the yacht.

"Now he's ready for the eyewitnesses—and the more the merrier. As soon as they start coming over the horizon, he recalls the homing base to the surface, uncouples the illusion from its mooring buoy and sends it homing to the base. As the illusion passes him, looking exactly like a real ship—and being avoided by other craft, exactly like a real ship—he kicks out a prepared hull panel in the yacht, which capsizes and sinks.

"The rescuers pick up the yachtsman, and he impresses upon them the fact that the *bow wave* has sunk him. While he keeps the witnesses busy, the illusion finishes its run, shuts itself off, couples itself to the homing base; and resubmerges. If the witnesses don't find the ship when they look for her again, they assume she has proceeded over the horizon."

Buchanan removed the pipe. "Don't be an ass, Schuster. The illusion can't go out like a light. She reduces over the base, keeping in scale. Trick perspective can fool the keenest eye. People have been known to walk through walls painted to lead to distances."

I was willing to take his word for it. I continued, "Well, after dark the trawler goes out, recalls and dismantles the gadgetry and hauls it home. The lawyer brings suit, and several months later the poor slobs aboard the victim-ship are being torn apart in a courtroom. The nearer they have been to the scene of the swindle, the less defense they have against perfectly honest and well-meaning eyewitnesses, and the stooge is awarded the million or so he is demanding.

"Because of the scientific preparation and legal aftermath, the swindlers probably can handle only one victim a year. But after a few years the routine goes so smoothly that the two shore men and the current stooge handle the actual trap. The inventor continues in his job as a chief engineer.

"Now, he has not tackled his own company because he knows they

would be tough. But he is put aboard the *Sea Loader,* and after a while the temptation to scuttle Hibbard is too much. I don't know when he prepares the duplicator tapes. Maybe he stops ashore one voyage, maybe the tapes are already on file. Anyhow, at this last turnaround in Perth Amboy the trap is finalized with the new stooge Donald Claremont. Then, unexpectedly, Schuster replaces Hibbard. For the first time, they are facing a strong skipper instead of a weak one. But the inventor gives the go-ahead."

Buchanan said quickly, "Why not? We had no way of knowing your course would lie so far off Cape Henry."

"You should not have sold me short as a navigator, Buchanan. If you've heard Mickleberry sounding off, you know I use less bunkers than any skipper in the Company. That's because I ride the currents the way an astronaut rides his orbit before letting it spin him onto his next course.

"The difference is this—a space orbit is a mathematical certainty, but a sea orbit shifts continually. Only a master mariner knows how to find the fast rim of the Gulf Stream. Too far west, he's in the strong southward current. Too far east—unless he's going that way—he's got to fight the Stream to get out of it.

"Until 24 hours ago I did not know where I would be steaming. But the rate of the current, the color and feel of the water, told me where the rim had shifted. So I slid onto it, cut the speed to Half Ahead and coasted, ready to spin off to Ambrose.

"You can call it luck or destiny. I call it hard work and experience. Whatever it is, it means you're all washed up."

Buchanan opened his eyes wider. "On what evidence? The so-called gadgetry will no longer be at the site of the caper."

"Yeah, but the *Amelia* with all those remote controls is still wrecked on the Continental Shelf, and I can make the Coast Guard dive for her by asking the captain of the *Halmar Cross* just one question: how long after the collision did the bow wave hit his tug?

"When he thinks back, he will realize *there was no bow wave.* And there goes the old ball game."

Buchanan sucked the pipe. "How can you identify the plotters?"

"Wake up, man! Mickleberry will come aboard tomorrow with a list of big-money ship-yacht settlements. Donald Claremont and all those other stooges are definitely not going to take the rap alone."

A pause. Buchanan asked, "How did I give myself away?"

"You came to the bridge on the muscle about trifles, and you were cocky enough to bait me. But even if you had controlled your feelings, you would have made the one real mistake."

He opened his eyes and held his breath. I told him, "You went into the chartroom to find out how far the ship had been from the trap at Cape Henry. Stunned by those hundred and

fifty miles, you left the dividers lying open on the chart. The distance they measured gave you away."

"Now what?"

"You'll be confined to quarters," I said shortly. I rose and got my passkeys from my desk. "But not your own quarters. God only knows what escape-artist gadgetry you have in there. You can spend the night in the pilot's cabin on this deck."

"I'm no Houdini." Buchanan seemed calm, but his lips were wax and his eye pouches were greenish again.

I motioned him to his feet. "Come over here and dump your pockets. I want your knife and belt. You intellectual types tend to go off the rails when your pride is crushed."

Buchanan stood up and moved slowly towards me. His eyes were wide open, the pupils like blank ball bearings. He put his fist over the pipe bowl, and I saw that the knuckles were white.

As his wrist turned, I punched him in the belly and chopped a hand below his ear. He fell like a stone.

The pipe lay in two pieces on the deck. Inside the stem was a glass hypodermic unit. No wonder the pipe had always been cold. I refitted the stem carefully so as not to break the glass tip, stepped out on deck and tossed the pipe over the side.

Then I phoned the mate's quarters and told him, "The heat must have got to Buchanan. He went berserk up here. I'm putting him in the pilot's cabin. Get a guard in the alleyway, right away, will you?"

Buchanan returned to the land of the living while I was taking his knife and belt. He choked hoarsely, "You're a real son of a bitch Schuster, you know that?"

"Yeah," I agreed. "That's the big difference between me and a dozen smarter men in the Company."

I hoisted Buchanan off the deck and propped him onto the settee. "Why self-destruct?" I asked him. "Spent all the chicken feed you got from the capers?"

"Chicken feed?" he flared. "I have a million dollars socked away where nobody can get their hands on it!"

"Fine. If the judge gives you ten years for grand larceny, you'll be earning a hundred thousand a year for sitting in jail. Most guys would be glad to have half your troubles."

"Glad to be taken ashore in irons? To be shamed, humiliated—!"

"Irons?" I snorted. "For a two-bit con artist? Who do you think you are? Jack the Ripper? Look, Buchanan, if you don't give me any trouble tonight, I'll let you clean up and make a decent appearance in shore clothes tomorrow—under supervision, of course. A lot of guys have cussed me out, but none of them ever said I kicked a man when he was down."

Buchanan could not meet my eye, but he began to perk up. By the time the mate and an AB came to the office, he was pretty much his old ironic self.

Well, we berthed at noon the next day as per orders. The pier was a mob

scene. We managed to repel all but official boarders, and eventually four of us convened in my office—Mickleberry, an insurance investigator, a Coast Guard commander and myself.

I had the bridge logbook on my desk, ready for Coast Guard scrutiny, but red tape always bugs me, so I said to the commander, "Jeez, you guys know me from way back! What went through your heads when you heard I was as far off course as Cape Henry?"

"As I understand it," said the commander, straight-faced, "there was some talk about flying out a psychiatrist."

Mickleberry liked that one. He and the insurance investigator were feeling good. They had a list of six ship-yacht settlements in eleven years and had already reasoned through to the shipping agent who must have been common to all of them.

I took a look at the sums involved and realized Buchanan had not been kidding about his million. Somehow I did not begrudge it to him. He had got a raw patent deal from some big corporation and had been turned a little haywire.

I told Mickleberry and the others the story, beginning from Buchanan's tension on the bridge and the carelessly dropped dividers. I finished, "I don't know how much of Buchanan's admissions to me can be used, but there should be enough evidence available without it."

I stepped into the alleyway and told the guard to bring Buchanan to the office. Buchanan came quietly. He was clean-shaven and neatly dressed in a good shore suit. He nodded at us and said evenly, "I admit nothing and won't talk until I consult my attorney."

This being fair enough, the commander left the office to arrange for Buchanan's formal arrest.

The insurance investigator said to Mickleberry, "It was lucky that your ace troubleshooter happened to be aboard this ship."

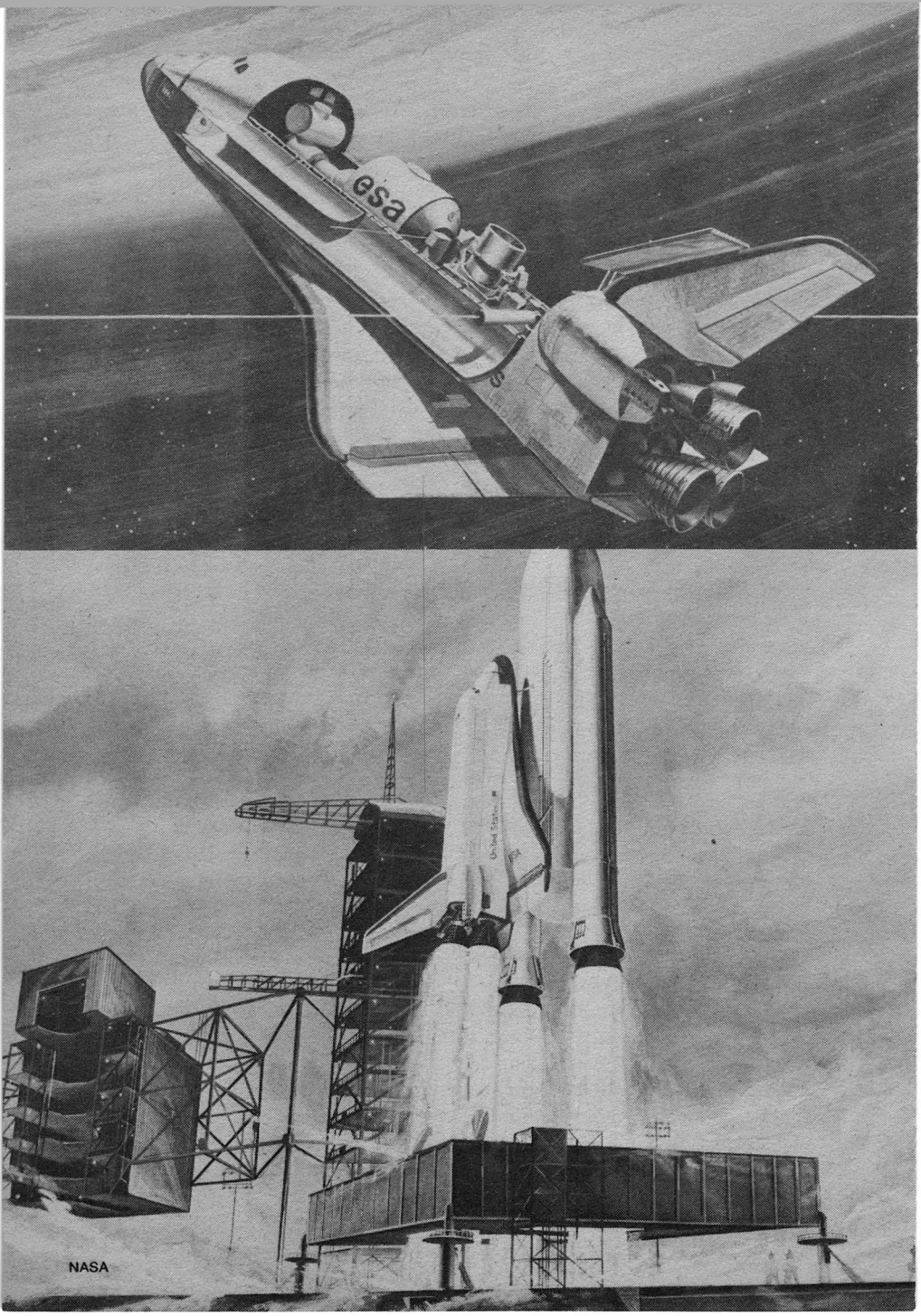
Buchanan spoke up irritably, "It's not luck!" Everybody looked at him, and he went on, "I remember a .400 hitter complaining about an outfielder who always hauled in his home runs. He said, 'It ain't that the bastard covers the outfield—it's that he stands there and makes the hits come to him'."

There was a short laugh. Buchanan went on, "It's something psychic. Schuster stands there and makes the action come to him. Maybe that's why he's an ace troubleshooter.

"The thing that was bull luck," he added, "was that Schuster caught onto the basics of the duplicator. The guy hasn't opened a book since he finally crammed his way past his shipmaster exams."

There was another laugh, and I grinned, "Yeah, I had horseshoes all over me."

I was not about to discuss what I know or do not know. When you come right down to it, keeping 'em guessing is really a troubleshooter's first law of preservation. ■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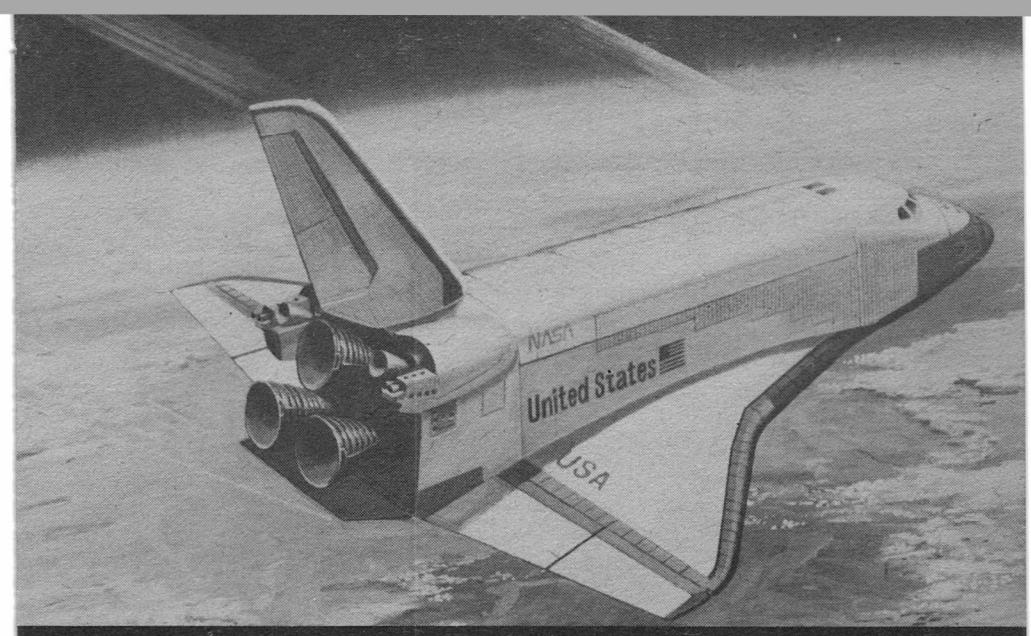


Will the first Shuttle pilot announce, "Re-entry will commence as soon as I work up the nerve!"?

Al Ragsdale

flying the space shuttle orbiter

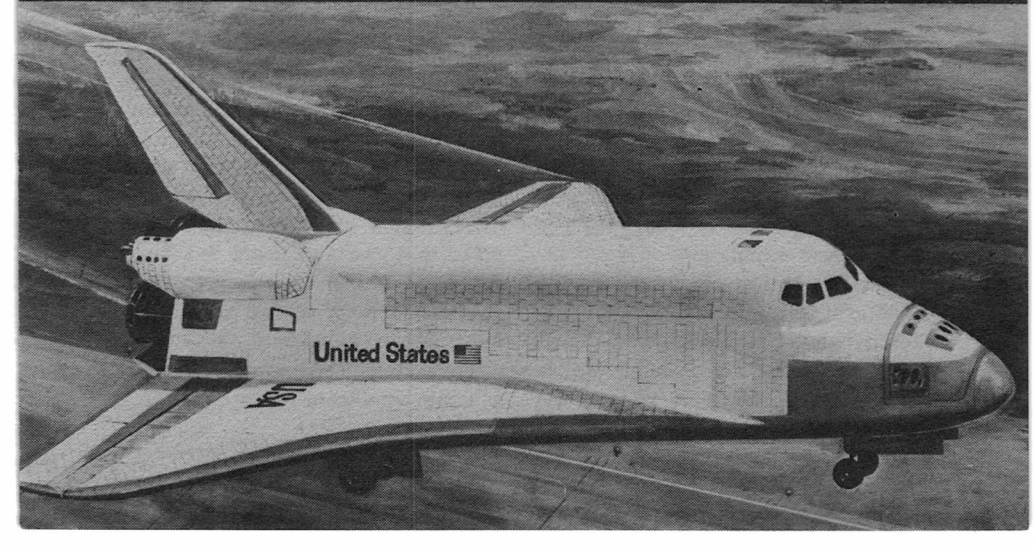
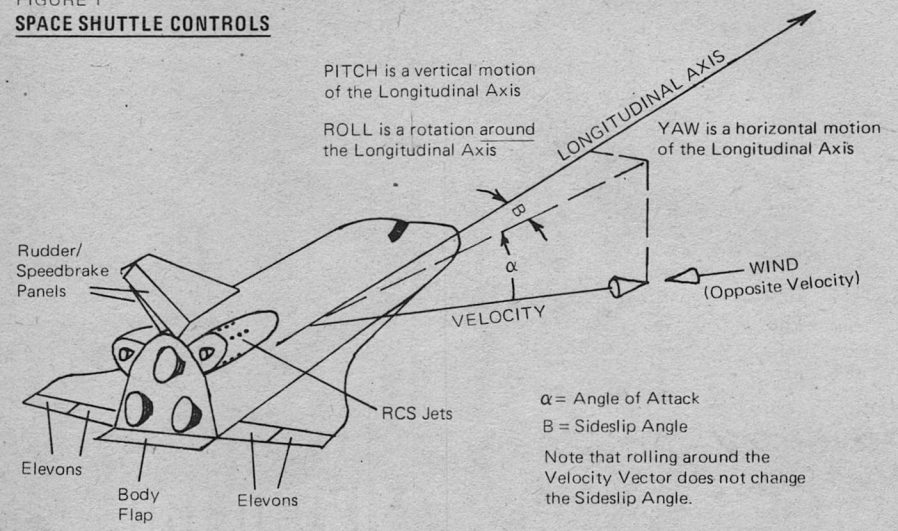


FIGURE 1
SPACE SHUTTLE CONTROLS



The Space Shuttle Orbiter is really the world's fastest glider. It must fly from orbit to a landing on a runway several thousand miles away without engines. It encounters every possible aerodynamic regime, from the near-vacuum of space to a subsonic landing. Because it is a compromise design, it can at best be called a clumsy flyer. Without the computers to help, flying the Orbiter back from orbit is a little like coasting down a mountain road backwards in a car out of gas, and stopping right in front of a gas pump! But simulations have demonstrated that a pilot can fly the Orbiter if he is aware of the changing aerodynamic conditions.

Like any other aerodynamic vehicle the Orbiter is flown by varying the forces it generates while moving through the atmosphere. These forces are determined primarily by the speed and direction of the relative wind—the airstream as seen from the vehicle.

The speed of the airstream is described as a Mach number—the ratio of the vehicle speed to the speed of sound. Below the speed of sound (subsonic) the airstream flows more or less smoothly. Above the speed of sound (supersonic) shock waves are produced which maintain a differential pressure above and below a vehicle. At Mach numbers greater than about 5 (hypersonic) a vehicle behaves almost like a kite—only those parts which contact the airstream directly generate significant forces.

The direction of the airstream is described by the difference between the direction the vehicle is pointing (attitude) and the direction it is moving (velocity). It may be broken into two components—the angle of attack (vertical component) and the sideslip angle (horizontal component). (See Figure 1.)

To rotate a vehicle, aerodynamic control surfaces are deflected into the airstream, like the rudder on a boat. The Orbiter has seven aerodynamic control surfaces. Four of these are on the rear of the wing (two per wing) and are called 'elevons' since they combine the effects of elevators and ailerons on ordinary airplanes. Deflecting all the elevons up or down will cause the vehicle to pitch up or down. If the right elevons are deflected up while the left elevons are deflected down, the vehicle will (usually) roll to the right, that is the right wing will fall while the left wing rises. The fifth control surface, called a 'body flap', is located on the rear of the fuselage and serves two functions—protecting the rocket engine nozzles from the airstream during entry and assisting the elevons for pitch control. The sixth and seventh controls are rudder/

Anybody can fly the Space Shuttle . . . almost.
Mr. and Mrs. Arthur Z. Gray of Florida visit the "cockpit" of the Shuttle simulator at NASA's Johnson Space Center, in Houston.

speedbrake panels on the rear of the vertical tail—a unique design. If only one of these panels is deflected the vehicle will yaw (the nose will move right or left). If both are deflected outward simultaneously the 'drag' force increases and the vehicle will slow down. This 'speedbrake' deflection is used for speed control during the final approach to landing.

In orbit there is not enough aerodynamic pressure for these control surfaces to have any effect. The Orbiter is provided with small rocket motors called Reaction Control System (RCS) jets for rotational control. One group of jets is mounted near the nose and are used only in orbit. More jets are mounted in pods on the upper rear of the fuselage and are used both in orbit and during entry. Depending on the direction they fire, RCS jets can pitch, roll, or yaw the vehicle.

In most airplanes there is a direct mechanical or hydraulic link between the pilot and the controls. In the Orbiter this is replaced by a 'fly-by-wire' Flight Control System or FCS. The pilot flies by sending electrical commands to the Flight Control System (actually a system of computers). The Flight Control System interprets these commands and generates signals to deflect control surfaces or fire RCS jets. (See Figure 2.)

The pilot can choose the mode of

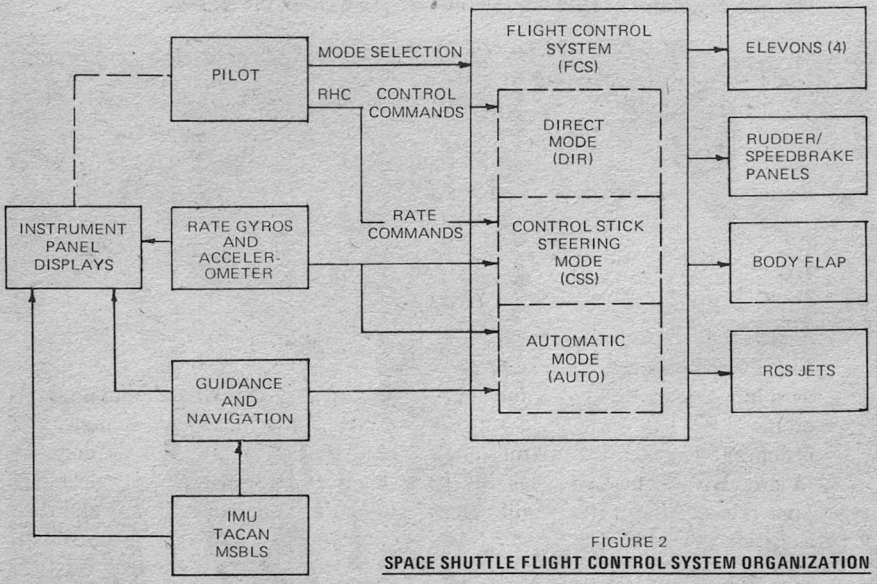


FIGURE 2
SPACE SHUTTLE FLIGHT CONTROL SYSTEM ORGANIZATION

operation of the FCS with pushbuttons on the control panel. Three modes are available—AUTO, CSS (Control Stick Steering), and DIR (Direct). The pilot can select separate modes for pitch, roll/yaw (both roll and yaw must be in the same mode), the speedbrake, and the body flap.

In AUTO mode the Orbiter is essentially like a missile—the pilot simply monitors the instruments to verify that the vehicle is following the correct trajectory. If it diverges from the trajectory the pilot can take over at any time by switching to CSS or DIR mode. The Orbiter has the capability of flying from orbit to landing in AUTO mode—only landing gear extension and braking to a stop on the runway are required of the pilot.

In CSS (Control Stick Steering) mode the pilot flies by deflecting a small pistol-grip stick called the Rotational Hand Controller (RHC) and ordinary rudder pedals. The RHC is mounted directly in front of the pilot below the instrument panel. The Flight Control System interprets RHC motions as rate commands in pitch, roll, or yaw (the larger the deflection, the larger the command). The FCS compares these commands with inputs from rate gyros and accelerometers (what the vehicle actually is doing) and generates control signals to produce the desired rates. If the pilot releases the RHC it will return to center, and the vehicle will maintain its present attitude (zero rates).

In DIR (Direct) mode the control surfaces and RCS jets respond only to the pilot's inputs (which are routed through the FCS computers). It is up to the pilot to coordinate turns, damp out oscillations, and maintain attitude. The same RHC and rudder pedals are used as in CSS mode. Flying the Orbiter in DIR mode is quite an exercise in aerodynamic stability and control, and quickly gives the pilot an appreciation for the Flight Control System.

There are three basic states of stability. Positive stability is like a cone resting on its base. If it is moved away from equilibrium it will return by itself. A cone on its side is neutrally stable. When disturbed it tends to continue moving at the same rate. A cone balanced on its tip is unstable (negative stability). When disturbed it moves further and faster from equilibrium.

In the first part of an entry the Orbiter is flying in a near-vacuum and none of the control surfaces are effective. It is in a classic state of neutral stability. Firing an RCS jet changes the roll, pitch, or yaw rate and the vehicle will continue to rotate at that rate until a jet is fired in the opposite direction *for the same time.*

The pilot's first task for entry is to line up the vehicle at a high angle of attack, some specific bank angle, and zero sideslip angle. This is done by slowly rotating the vehicle one direction at a time with RCS jets and then stopping all rotations (if possible!). This can be done very easily in CSS mode, but is tricky in DIR mode since

it is nearly impossible to get a rate of exactly zero.

For the first few minutes of an entry not much happens. The Orbiter flies at a high angle of attack (30 to 40 degrees) so the bottom of the wing and fuselage are exposed to the airstream. Like the 'heat shields' used on space capsules, the bottom of the Orbiter is designed to absorb the intense heat caused by the high speed of entry.

Around 280,000 feet (85 km) altitude enough aerodynamic pressure is developed for the elevons to control pitch. The pitch RCS jets are shut off to save fuel. The Orbiter is reasonably stable in pitch and the pilot can control pitch without a great deal of effort.

The Orbiter is *not* stable in yaw, though. This is caused by three factors—the high angle of attack puts the tail in a near-vacuum; the airload on the forward fuselage increases the yawing movement if the vehicle yaws (which can cause a 'spin'); and the elevons generate more yawing movement (in the wrong direction) than they do rolling movement! A comparable situation is backing a car at high speed—make one wrong move and you've had it!

At first the roll and yaw RCS jets can overpower this aerodynamic instability by brute force. But as the air pressure increases it soon becomes necessary to use the elevons for roll control.

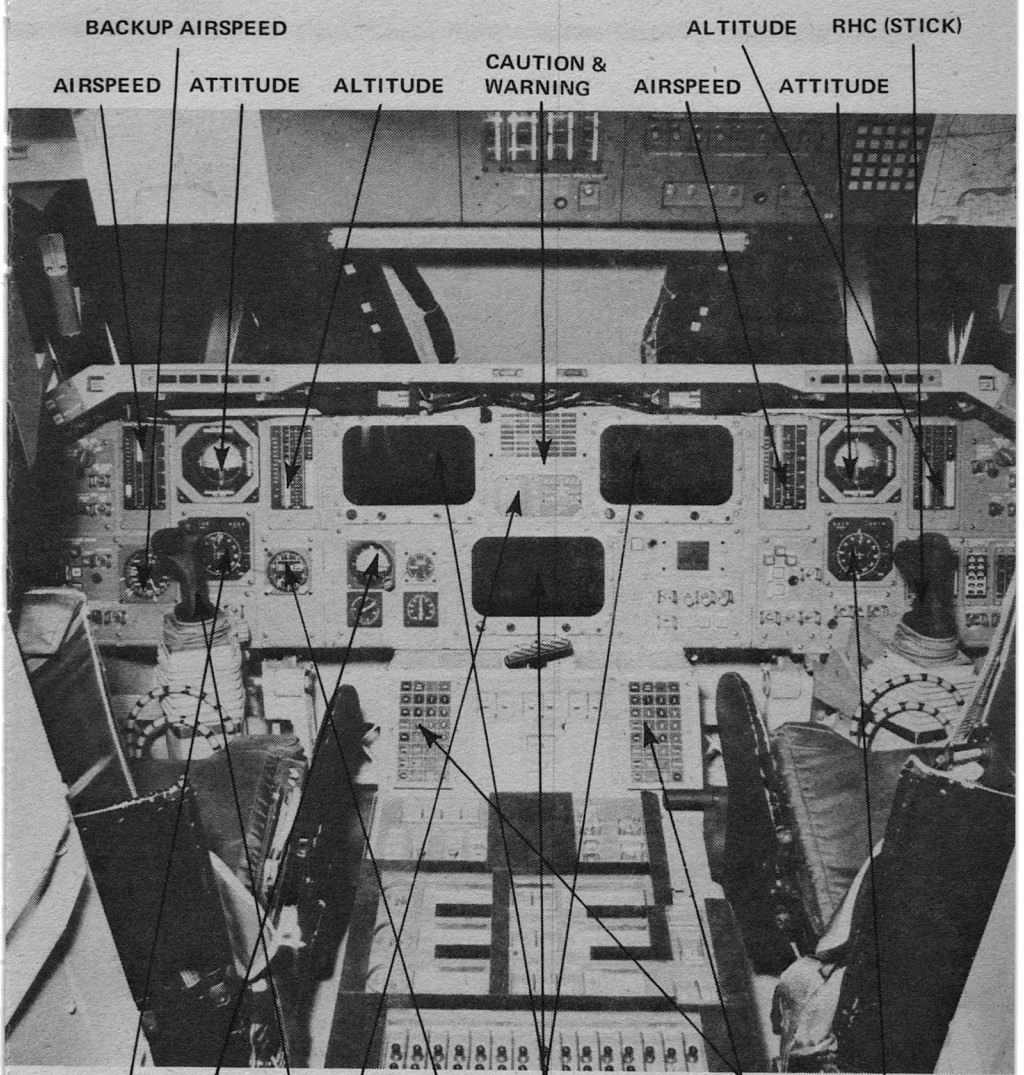
The roll RCS jets are shut off to save fuel. The CSS mode uses a combination of elevon pulses and yaw RCS jets to rotate around the relative wind vector (a coordinated roll and yaw) instead of the longitudinal axis (a pure roll). This keeps the sideslip angle very close to zero. But the pilot doesn't have to think about it. He simply tilts the stick and the Orbiter responds as it should.

If he must resort to DIR mode, the pilot has quite a problem. Moving the stick to the right causes the Orbiter to roll to the left! The downward deflecting elevons drag one wing back to create a sideslip. This increases the lift on the opposite wing and picks it up. So the vehicle ends up rolling toward the downward deflected elevon, opposite the way it 'should.' To make matters worse, since the vehicle is rolling around the longitudinal axis the sideslip will then reverse.

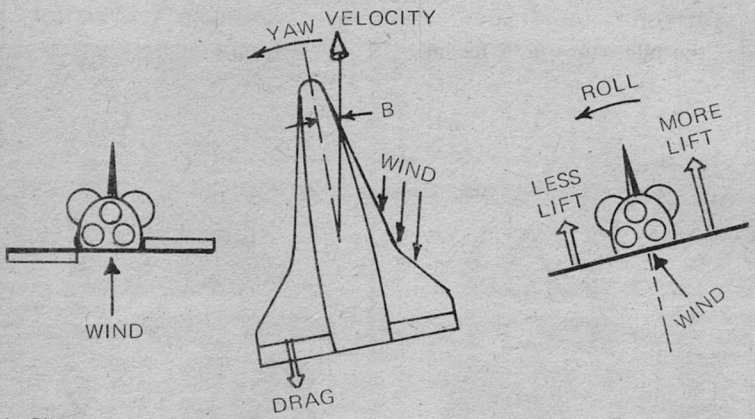
The Space Shuttle controls and instrument panels.

To demonstrate what is happening, hold a pencil under your palm at an angle of about 30 degrees from it. The pencil represents the airstream direction and your palm the Orbiter. If you rotate your palm (roll the Orbiter) 90 degrees the angle of attack will go to zero and the sideslip angle to 30 degrees. If you rotate your palm back (because the sideslip picks up the lower wing) the sideslip will go back to zero and then in the opposite direction.

Since the Orbiter is unstable in yaw



THE OAS COCKPIT



1. Pilot moves RHC to right. Elevons deflect as shown.

2. Downward Elevon drags left wing back, produces sideslip.

3. Sideslip increases lift on right wing. Vehicle rolls left.

4. As bank increases sideslip reverses. Pilot deflects elevons again to the right.

5. Elevon drags left wing back to zero sideslip.

6. Vehicle is now rolling to the left. To stop the roll, make another 'Double Pulse' to the left.

FIGURE 3

DIRECT MODE ROLL DURING ENTRY

(Sideslip and Bank Angle are exaggerated for clarity)

it will oscillate back and forth in what is called a 'Dutch Roll' getting larger and larger until it goes out of control, unless the pilot stops it. A technique for flying DIR mode has been flown many times by the astronauts on simulators. It consists of a 'Double Pulse' of the elevons. The first pulse is made *opposite* the direction the pilot wishes to roll. The second pulse stops the resulting sideslip. It's a little like riding a bicycle facing backwards—it takes practice, but it can be done! Figure 3 shows the details of this technique.

During entry the Orbiter must follow an angle of attack versus Mach number profile to avoid overheating or generating 'phugoid oscillations.' These are large up and down skips through the upper atmosphere that make gliding to a target very difficult. The descent rate is controlled by varying the bank angle as shown in Figure 4. This changes the vertical component of the aerodynamic lift, and is called 'dumping lift.' The usual profile consists of a bank angle that starts as high as 80 degrees and slowly decreases.

After several minutes this steep bank angle turns the Orbiter a few degrees away from its target. When a limit error is reached, the bank angle must be reversed to fly back toward the target. This 'Bank Reversal' maneuver is done three or four times in a normal entry. In other words the Orbiter flies a series of elongated 'S-turns.' If the bank angle is maintained in the same direction the Orbiter can land about 1100 nautical miles (2000 km) off its original orbital track. This is enough to land back at the launch site after one partial orbit.

At some point the Orbiter must pitch down to a lower angle of attack so it flies like an airplane instead of a capsule. This 'Transition' maneuver begins around Mach 8 and lasts until Mach 1.5. Since the roll control is 'reversed' at high Mach numbers and normal at low Mach numbers, somewhere in between the elevons cannot be used for roll control! This occurs during the Transition maneuver, from about Mach 4 to Mach 2. Fortunately by this time the rudder is partially

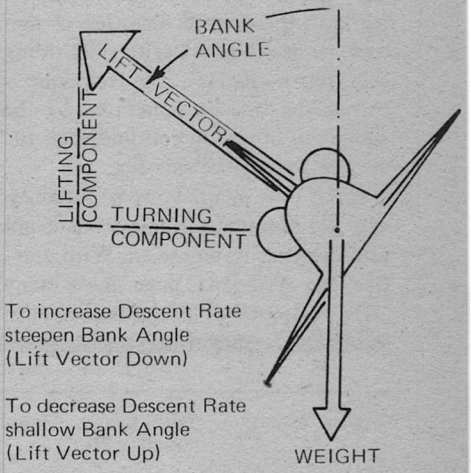


FIGURE 4
CONTROLLING DESCENT RATE WITH BANK ANGLE

exposed to the airstream due to the lower angle of attack. The CSS mode uses a combination of rudder, elevons, and yaw RCS jets to roll around the relative wind, as before.

In DIR mode the pilot can control roll with the rudder and sideslip with elevons. This is opposite the normal controls, but at least the inputs are made in the desired direction of motion, rather than opposite (like riding a bicycle no-hands). The technique is to use the sideslip generated by the rudder to initiate a roll and then the elevons to stop the sideslip.

Since only a few large roll maneuvers are required for entry, this is not as difficult as it may seem. With practice, the astronauts have flown many DIR mode entries on simulators, even with the RCS jets turned off!

Around Mach 1.5 the Orbiter begins to fly something like a normal airplane. It will be about 70,000 feet (21 km) high and about 30 miles (50 km) from the landing field. Although the pilot will usually be able to see the airport, an instrument approach is needed. The 'deadstick' (gliding) approach can be made with ordinary radio navigational aids—a TACAN and localizer. The TACAN gives the pilot his distance from the airport and the direction to it. The localizer tells him if he is right or left of the runway centerline. (See Figure 5.)

The Orbiter also has an Inertial Measurement Unit (IMU) which provides its position at all times. A Microwave Scanning Beam Landing

	ORBIT	ENTRY	TRANSITION
Typical Speed	2500 fps Mach = 30	Mach > 8	Mach > 1.5
Typical Alpha	--	30° to 40°	30° to 10°
Typical Bank	--	80° to 30°	45° to 0°
Pitch Control	RCS Jets	RCS & Elevons	Elevons
Roll Control	RCS Jets	RCS & Elevons (DIR Mode—Opposite)	RCS, Rudder & Elevons (DIR Mode—Rudder Only)
Yaw Control (Sideslip)	RCS Jets	RCS (DIR Mode—Elevons)	RCS (DIR Mode—Elevons)
Stability			
Pitch	Neutral	Positive	Positive
Roll	Neutral	Neutral	Neutral
Yaw	Neutral	Negative	Negative

FIGURE 6
SPACE SHUTTLE FLIGHT REGIMES

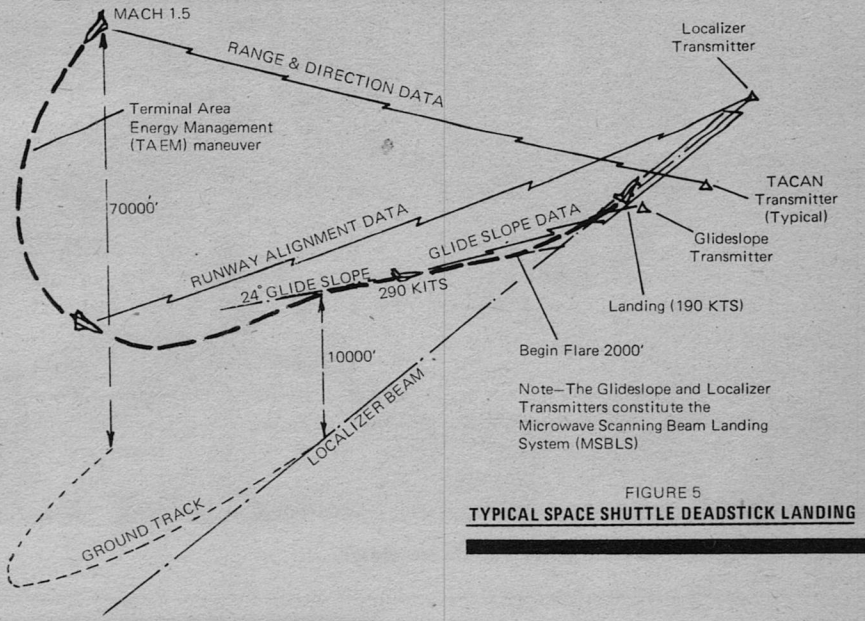


FIGURE 5
TYPICAL SPACE SHUTTLE DEADSTICK LANDING

TAEM	LDG APPROACH
Mach ⟨ 1.5	290 KTS
10°	5° to 10°
45° to 0°	30° to 0°
Elevons	Elevons
Elevons (Conventional)	Elevons (Conventional)
Rudder	Rudder
Neutral	Negative
Neutral	Neutral
Positive	Positive

System (MSBLS) provides additional glideslope, localizer, and distance information. The pilot could also be 'talked down' by chase planes or ground controllers.

Prior to lining up with the runway the Terminal Area Energy Management (TAEM) maneuver is performed. This consists of a descending turn performed several miles off the approach end of the runway. The objective is to put the Orbiter on the glideslope at the proper airspeed without having to do a last-minute dive or 'stretching the glide.' By comparing his altitude with his range from the airport the pilot can determine if he is high or low. If high, he opens the speedbrake and steepens his descent. If low, he closes the speedbrake and

Author Ragsdale at controls of Shuttle simulator.

flies a shallower glide path. On the glideslope the speedbrake is set about half-open. The airspeed stabilizes near the approach airspeed of 290 knots (540 km/hr), about double the approach speed of airliners. The Orbiter should be on the final approach by 10,000 feet (3 km) altitude.

This last two minutes of flight is really the most exciting and critical part of the entire entry. The Orbiter descends at an angle as steep as 24 degrees (eight times as steep as an airliner approach!) aimed at a spot about a mile (1½ km) in front of the runway. About 2000 feet (600 m) high the pilot starts to pull up or 'flare.' The landing gear are extended at about 1000 feet (300 m). As the Orbiter approaches touchdown the pilot must maintain a sink rate less than 10 feet (3 m) per second. The Orbiter usually lands about 3000 feet (900 m) down the runway at a speed of about 190 knots (350 km/hr). With maximum braking it can be stopped in less than 5000 feet (1500 m).

Landing the Orbiter is tricky in either CSS or DIR mode (and gutsy in AUTO mode!). The high sink rate leaves little margin for error. During the final flare the vehicle slows down about 5 knots (9 km/hr) each second, and it quits flying ('stalls') at about 150 knots (280 km/hr), which is why the final approach is flown at such a high airspeed. (See Figure 6.)

Landing a heavy sensitive vehicle without power requires a lot of practice. But when the Space Shuttle

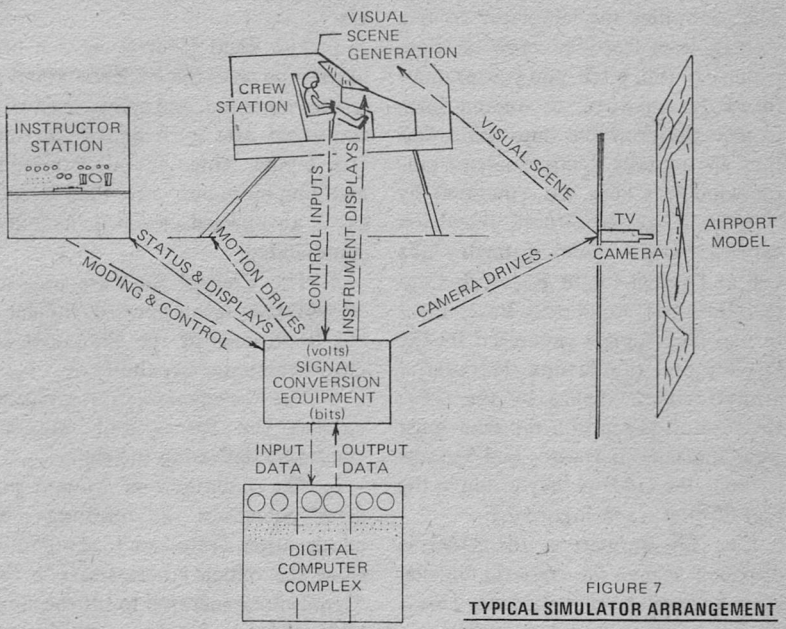


FIGURE 7
TYPICAL SIMULATOR ARRANGEMENT

Orbiter actually flies, the pilot will have flown literally thousands of landings in simulators and training aircraft under every conceivable condition. The task will seem almost routine to him.

Almost.

One of the primary simulators that will be used for training the Space Shuttle crews will be the Shuttle Mission Simulator (SMS). This simulator is presently under construction at the Johnson Space Center in Houston. Its forerunner, the Orbiter Aeroflight Simulator (OAS), is already operational and will be used to train crews for the Approach and Landing Test (ALT) flights, which began in July, 1977.

The OAS is designed to simulate only the approach and landing of the Orbiter. Since July, 1977 the Orbiter has been carried up to an altitude of about 25,000 feet (8 km) and 'dropped' by a Boeing 747. The crew flies the Orbiter to a deadstick landing to verify that the Orbiter systems are adequate for the critical landing approach. A series of several drop flights are being conducted, testing various flight control modes and approach profiles.

Built by the Link Division of the Singer Company, the OAS is the

world's most advanced 'Link Trainer.' The crew flies the simulator from a six-degree-of-freedom crew station, which can roll, pitch, and yaw or move forwards, sideways, or up-and-down to give the crew the impression that they are actually flying. Realistic out-the-window scenes are generated by 'flying' a closed-circuit television camera above a model of the dry lake bed at Dryden Flight Research Center, Edwards Air Force Base, California. The sounds generated by the Orbiter and the Boeing 747 carrier aircraft can be heard by the crew. Because of its realism, the crew must wear the same harnesses and helmets in flying the OAS as they would in the real Orbiter. (See Figure 7.)

Like all simulators, the OAS is designed to give the crew the illusion that they are in a real airplane. This is done by cycling digital computer programs at high speed to generate the response of the aircraft instruments, visual presentation, and motion cues so rapidly that it appears to be happening in 'real-time.'

For example, if the pilot were flying a landing approach, and his glideslope indicator showed he was low, he would deflect the stick back to pull the nose up. The following sequence takes place in the simulation:

1. The deflected stick generates a proportional voltage which is converted into a digital signal (a string of computer 'bits') which the computers can interpret.

2. The Controls and Displays program scales the digital signal as required by the flight control computers.

3. The flight Control System program interprets the stick command as a rate command, and compares it with simulated rate gyro and accelerometer inputs. Since the stick is commanding more pitch rate than already exists an upward elevon deflection is commanded.

4. The Control Surfaces program 'moves' the elevon upward, subject to the limitations of the simulated hydraulic actuator capability.

5. The Aerodynamics program calculates the forces and moments caused by deflecting the elevon.

6. The Equations of Motion program calculates the resulting pitch acceleration, rate, and attitude to show the vehicle's nose starts to rise. Signals are generated to tilt the simulator and the visual presentation. As the nose starts to rise more 'lift' is generated and the vehicle starts to move upward.

7. The Navaids (TACAN, MSBLS, Radar Altimeter, and IMU) programs sense this upward motion as a movement toward the glideslope.

8. The Guidance program calculates a smaller error since the vehicle is moving toward the desired position.

9. The Controls and Displays program scales the reduced error and produces a smaller needle deflection command.

10. This deflection command is converted to a proportional voltage that deflects the glideslope indicator,

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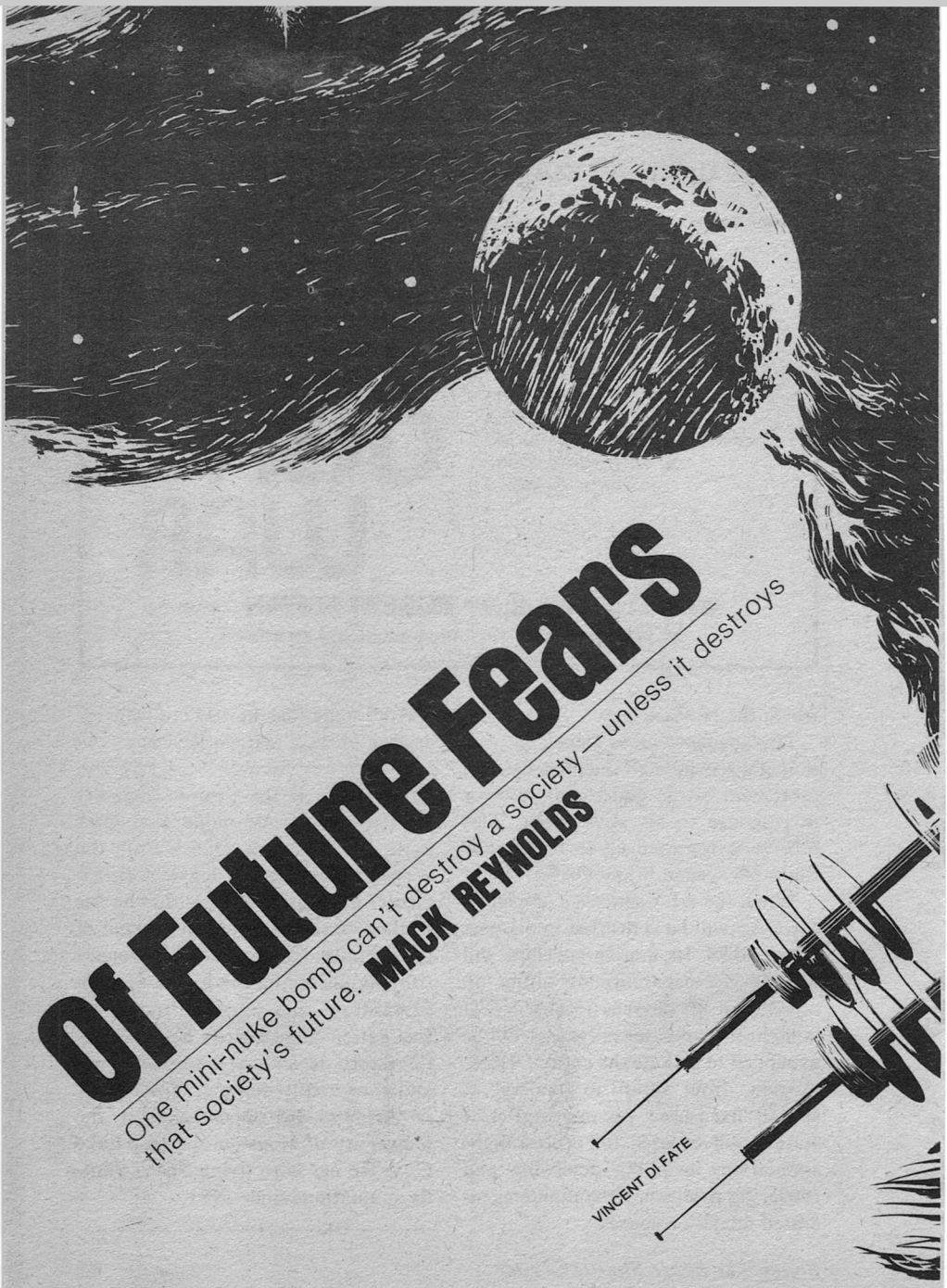
which the pilot can see.

This sequence takes place in a fraction of a second—all the pilot sees is a movement of the glideslope indicator in response to his stick input. This process is repeated up to twenty-five times per second in the OAS.

When the ALT series is completed, the OAS will be converted into a part of the SMS. Its motion envelope will include the capability of tilting up more than 90 degrees to simulate a launch. Its computer programs will be expanded to include the entire Orbiter mission, from liftoff to landing. A second 'fixed-base' (nonmoving) crew station will be used for orbital flight simulation, including deploying and retrieving payloads via computer-generated television scenes.

And sometime in 1979 it will all happen in the ('real world')! ■

Al Ragsdale is the Project Engineer for the Orbiter Aeroflight Simulator built by the Link Division of the Singer Company at Johnson Space Center in Houston. Since 1967 he has worked on the design and checkout of the simulators used for astronaut training, including the Lunar Module Simulator, and Crew Procedures Evaluation Simulator (a Space Shuttle testbed device). Al is a private pilot and is currently doing graduate work in Avionics Instrumentation at the University of Houston at Clear Lake City. He has been flying Space Shuttle simulations since 1971.



Of Future Fears

One mini-nuke bomb can't destroy a society—unless it destroys that society's future.

MACK REYNOLDS

VINCENT DI FATE

SYNOPSIS

It is some time after the turn of the century. Terrorists, headed by Nayef Habash and a mysterious stranger called The Expert, hijack an American developed mini-fusion bomb designed to be so simple that anyone could activate it. It was designed to be used after one side had irrevocably lost a war. *In short, it's a revenge weapon to decimate the former enemy's population centers. In the face of horrified worldwide revolt, it had been scheduled to be disassembled, to herald a new détente.*

Rex Bader, "the last of the private eyes," is called in to act as liaison man between the Inter-American Bureau of Investigation, Lady Cecila (Sissy) Duff-Smythe, of Scotland Yard, Jean-Paul Lafitte, of Interpol, and Ilya Simonov, of Russian intelligence, and the IABI, by John Mickoff the right hand man of John Coolidge, the IABI's Director. They do not wish publicly to admit that the United States is calling in assistance. Usually on Negative Income Tax, Rex is promised a job if his "team's" efforts are successful.

There is animosity between Sissy and Ilya Simonov, since she suspects he killed her brother. Jean-Paul, easygoing, is continually joking about collecting American graffiti.

Alioune Senghor, a young Senegalese student at New Princeton is approached by Mamadou Diop, a high ranking Senegalese diplomat, and talked into sheltering the mini-nuke, and it is left in his keeping.

Simonov, Sissy and Jean-Paul, working separately, though in conjunction with Rex, each trace down the mini-nuke and zero in for its recovery.

Meanwhile, The Expert approaches Anthony Damon, a present day don of what used to be called the Mafia, and talks him into hijacking the horror weapon from the terrorists with the idea of extorting a billion pseudo-dollars from the Reunited Nations.

In the midst of a conference with his "team" Rex gets a phone call from a would-be client who wants a private detective. It turns out to be Alioune Senghor, who explains to him, after the team has cleared out, that the bomb is in his quarters. He has discovered that Mamadou Diop lied to him.

They go to the student's apartment and run into a shoot-out in which the mini-nuke is taken from the terrorists who are all killed. Rex and Jean-Paul are slightly wounded.

There is another conference in Mickoff's apartment in which Coolidge reveals that there has been a letter from a group calling themselves The Extortionists, in which they demand a billion pseudo-dollars in return for not exploding the bomb in a major city. They also demand that no police organizations be utilized to frustrate them. In short, the team cannot operate.

Jean-Paul, Sissy and Simonov "resign" from their organizations, intending to continue their investigation

with Rex. Coolidge and Mickoff disavow them. Rex comes up with the information that only the Mafia is large enough an organization to have pulled off the theft.

Rex and Sissy leave Jean-Paul at a sidewalk cafe while they go for a conference with Sophia Anastasis a top official of International Diversified Industries, a legal organization which the once Mafia has now become. She scornfully rebuffs them, pointing out that her organization is now one of the largest conglomerates in the world and not interested in crime. However, Rex deduces that she might know who is *involved.*

Meanwhile, at the cafe, Jean-Paul is abducted by some well dressed goons to be taken to see their Chief. When Sissy and Rex return, they are dismayed and go back to his apartment. There, they are phoned by Mickoff and told that Rex's detective license has been rescinded, that Sissy and Jean-Paul have been declared persona non grata *and their credit cards invalidated, and Ilya Simonov is being sought with orders to be shot on sight. Coolidge does not want to antagonize the Extortionists before the government can come to terms with them.*

Sissy, obviously, cannot return to her hotel and so, somewhat nonchalantly, spends the night with Rex.

Meanwhile, The Expert is on the carpet before Damon and two other high ranking Mafiosi. He defends his actions and points out that they can't do without him, since only he knows that secret part of the mini-nuke which has been removed. Just before he is to depart, the phone rings. It is Sophia Anastasis—boiling mad and wanting to talk to Damon.

In the morning, Ilya brings Jean-Paul, badly battered, back and explains that he has rescued the Frenchman from his kidnappers. They find that Rex's Priority One on the data banks is still operational, indicating that Mickoff is still trying to give them as many breaks as he can. A Professor Gunther has been kidnapped by the Extortionists. The team finds that his assistant, Frank Turin, is Italian, and asks for his complete Dossier from the data banks.

The Expert goes to the headquarters of the Anarcho-Syndicalists International and presents letters of introduction from foreign radical organizations which pronounce him an international revolutionist. He satisfies their doubts by proving himself highly knowledgeable about Marxism, revolutionary terminology, etc. When they ask him why he has come to America, he tells them—

"I want to blow up Lagrange Five and prevent the building of the space colony."

CHAPTER EIGHTEEN

They were staring at him as though he were a madman.

"Comrade," the chairman blurted. "we are anarcho-syndicalists, not nihilists!"

The Expert nodded, very seriously. "Of course not. The nihilists were basically wrong. They believed that by threatening and even assassinating top aristocrats, especially in czarist Russia, they could force the rulers to grant reforms to the proletariat and the peasantry. They were surprisingly successful in killing several Grand Dukes and such, and even one Czar. But the reforms were not forthcoming. The ruling class simply upgraded new aristocrats into the positions vacated. Terrorism has never paid off in the history of revolution."

"Then why this act of terrorism?" the girl demanded.

He looked at her and shook his head. "I am not talking about an act of terrorism. That is not what I have in mind."

He stood and went over to the bewhiskered portrait of Karl Marx and stared up at it. He wondered why every portrait he had ever seen of the nineteenth century economist seemed to have been taken when Marx was at about the age of fifty-five. He could not recall ever having seen a portrait of Marx as either a young man or one taken shortly before his death at sixty-five.

The others were scowling, puzzled at him.

He finally turned back to them, and pointed a finger up at the portrait. He said, "Today, we revolutionists still usually refer to ourselves as Marxists, though long since much of what he taught has become antiquated. We have gone far beyond what he was able to comprehend almost a century and a half ago. Marx was a product of his time and analyzed laissez-faire capitalism, classical capitalism. But capitalism has evolved, since there is evolution in society as well as in biology. The program he and Engels outlined in the *Communist Manifesto* in 1848 is so passé as to be almost laughable. Indeed many of the supposedly radical changes advocated at that time have since been adopted by capitalist society—a graduated income tax, for instance, and free education for children."

He thought about it for a moment. "A present-day naturalist or biologist wouldn't dream of calling himself a Darwinist, no matter how great an admirer of Charles Darwin he might be. Not that the basic work of Darwin isn't still valid, it's just that so much new has been discovered."

He returned to his chair. "But we still think of ourselves as Marxists and, indeed, the very basic elements of our theories are based on the Law of Surplus Value and the Materialist Conception of History."

"This is rather basic, Comrade," the chairman said.

"Yes. And—following the Law of Surplus Value—unless we blow Island One, the proletarian revolution will not take place in our lifetime, and possibly never."

They were gawking at him again, almost as they had when he first threw his bombshell.

The girl snorted, "What in curd are you talking about, Comrade?"

He nodded acceptance of her indignation. "Let me sum it up—the proletarian revolution is not inevitable. The new society will evolve, if and when it comes, out of capitalism, as capitalism did out of feudalism, and feudalism out of chattel slavery, such as prevailed in Rome and before. But it will not come about automatically. There are some requirements, some requisites, one of which is an economic collapse of the capitalist system. A collapse so complete that there is no alternative but to build a new society. A collapse as complete as that of the Roman Empire, which led to feudalism. That is what we of the revolutionary movement have been waiting for—for almost two centuries."

"That's elementary," the Germanic one growled.

The Expert accepted that with a nod. "According to Marx's Law of Surplus Value, capitalism must expand. It cannot stand still. If it fails to expand, it goes into a depression and ultimately collapses. According to this economic law, the proletariat is given in wages only a fraction of the product it produces and hence can only buy back a fraction of the commodities that go upon the market. The capitalists thus have a glut on their hands. They can waste some of it on high living, they can expend some of it in maintaining their state—their police, their armies, their law courts, their jails and all the rest of it. They can blow some of it up in their wars, though with the advent of nuclear weapons, wars are less practical than before—they threaten to kill everybody, including the bourgeoisie. But they still have a surplus and if it remains on the market, a depression results. Why produce more commodities, if you can't sell those you have on hand? So the final answer is expansion. The surplus value produced by the proletariat is expended upon expansion. New markets are found, new frontiers opened, new factories, mines, mills, shipyards, and aerospace plants, built."

"Come, come, Comrade," the chairman said impatiently. "I learned all this at the age of twelve."

The Expert nodded again and said, "I too was born into a radical family, Comrade." But he went on. "When new frontiers and new markets for commodities cannot be found, capitalism has its depressions—they used to call them panics—and unless some way out is found, the system collapses. I repeat, that is what we have been waiting for. It has been long acoming. In 1848 Marx expected such a collapse to take place in the near future, but in 1849 gold was discovered in California and the stimulus it gave produced a new lease on life. Whole areas of the globe were opened up, including North America."

He paused again, before adding, "But by the time of the First World War, there were, for all practical purposes, no new frontiers. The collapse began. However, the war rescued the system. Millions of people killed, cities were razed, whole countries made into wastelands. Capitalism

could make do for over a decade in reconstructing, rebuilding. But then the final collapse of laisse-faire capitalism took place in 1929, a worldwide depression. For a decade capitalism writhed and, once again, recovered only under the stimulus of the Hitler War. And this time it took a much larger war to do the job. When it was through, something like forty million persons had lost their lives and half of Europe, including Russia, had been leveled. Capitalism—largely state capitalism now—thrived again, rebuilding."

He looked around at them. "They cannot risk another war, comrades. Not with nuclear weapons in the hands of practically all. And there are no new frontiers. There are no new markets. Automation and computerization have finally brought us to the point where a mere fraction of the working class is needed to produce all that society can consume. Nine-tenths of the proletariat is idle, and restive. And they become more restive under the Ultra-Welfare State every day. The capitalist collapse is again on the agenda."

The chairman agreed to that. "Never in my memory are we getting such response. Our membership swells, perhaps doubles every few months, almost entirely from the ranks of those on Negative Income Tax, though many of the intelligentsia also become converted to our cause when they see there is no other answer and that a new social system must be built which will utilize the efforts of all of the people to make a better world."

"Yes," The Expert said simply. "And if we are to succeed, capitalism must not find its new frontier where it can again expand."

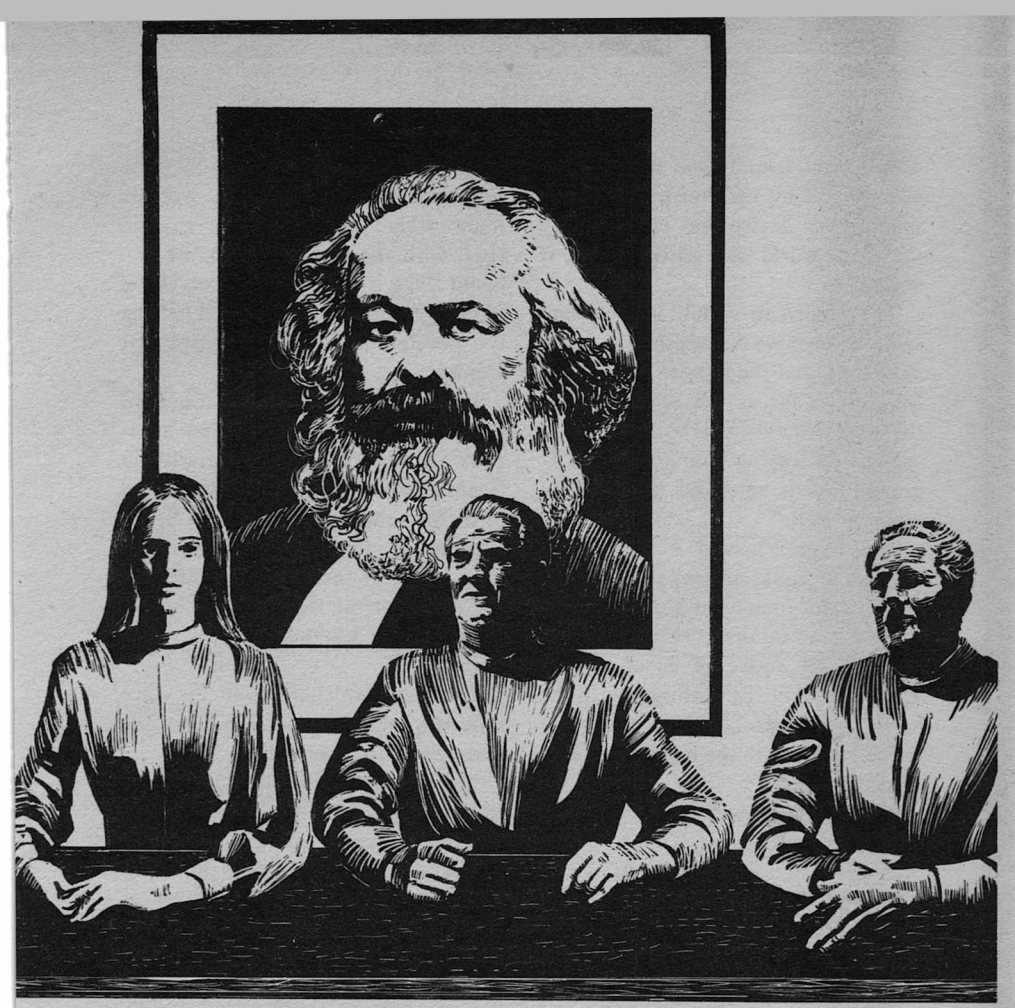
They were taking him in thoughtfully now, obviously beginning to get a glimmering of what he had been building up to.

"Let me tell you about the present space program and Lagrange Five," he said.

The Expert took considerable time to go through it all, and his audience began to show signs of restlessness.

The Germanic one said, "Very well, and now Lagrange Five is operational, after a slow start. Island One is under construction. But even if completely successful and this physicist's dream is realized, it involves only ten thousand people, hardly enough to create the new frontier that you point out capitalism needs. If there is financial objection to this Island One space colony, what will it be when they begin on Island Two, as projected?"

"You miss the point," The Expert said. "Island One is expected not only to begin immediately to pay its own way, but to embark on the construction of Island Two, a larger space colony, which, when completed, would begin the construction, in conjunction with Island One, of Island Three. And Island Three is expected to be able to begin to mine the asteroid belt, some 100 million miles away. The asteroids are composed largely of nickel and iron and one cubic mile of them could



provide ten times the amount of steel that the world now uses annually. In a way, the growth of the space colonies would be a geometric progression, each one built would lead to the building of at least two more—at their own expense and no longer dependent upon resources from Earth. The asteroids, by the way, also contain hydrogen, nitrogen, and carbon, and hydrocarbons are the basis of plastics, innumerable fibers and fabrics, and even soft ice cream."

They were staring at him again. He added gently, "Island Four is expected to be sixteen miles long, four miles in diameter, and could house a few million emigrants."

"Jesus," the girl said.

The Expert said, "One manner in

which even Island One will pay its own way is by the construction of a solar power device that could supply the whole world with all the energy it needs."

The chairman shook himself and said, "Even if we accepted all that you have said, and the danger of this new frontier, as far as the revitalizing of the capitalist system is concerned—to suggest destroying Island One at Lagrange Five is nonsense. We couldn't possibly do it."

The Expert looked at him. "The mini-nuke would destroy it."

The older man eyed him as though he had gone insane. "The mini-nuke! We are all aware of it, of course. There is practically nothing else in the news. The world has gone quite hysterical. But it is in the hands of vicious extortionists."

The Expert agreed to that. "I know. But I know where it is, and a half dozen comrades could seize it."

The one member of the committee who had remained silent thus far, said in disgust, "Perhaps we are different from the Common Europe comrades who sent you with your letters of introduction, but we have no arms."

The Expert looked at him levelly. "I can supply the necessary arms. Surely, some of your younger members have had military training."

The girl was equally disgusted with the whole proposition. "Look here," she said. "You're being impossibly romantic—as impractical as those comrades who assassinated the Archduke Ferdinand in 1914 and precipitated the First World War. Suppose that everything is true, that you do know where the mini-nuke is, and that, with the arms you promise, we could seize it. That is a far cry from blowing up Lagrange Five and halting the development of a new capitalist frontier."

He lowered his eyes and put his two hands down on the table that separated them. "We have comrades in Spain and Italy who are activists. One of them is capable of piloting a Space Shuttle. It would be a matter of seizing one of these space vehicles at the spaceport at Beni-Abbes and his taking off for Lagrange Five with the mini-nuke."

The German-looking one, his voice reflecting the utter rejection of the rest, said, "He would die!"

"He is a lifelong friend and comrade of mine. He considers himself expendable for the movement."

Not since the days of the early twentieth century, when anarchosyndicalists such as Joe Hill had gone down in the vicious industrial warfare that had prevailed, especially in the American West, had there been much in the way of violence on the American radical scene. Save for a few crackpots such as the Weathermen and the Symbionese Liberation Army and related organizations, the true revolutionists had foresworn the use of force as a method of bringing to fruition the new society. They had turned to legal means, including the ballot, rather than calling for insurrection in the streets—

And that was now on the faces of the National Executive Committee of the Anarcho-Syndicalist International.

The chairman shook his head. "When it got out that we revolutionaries had undertaken an action resulting in the deaths of two thousand workers, on all levels, at Lagrange Five, the world reaction against us would be such that we could never come to power. Look what has happened to the terrorists in the Third World countries, since they hijacked the mini-nuke and precipitated all this hysteria. They have all but disappeared. The human race hates them. And now it hates the Extortionists who are presently attempting to blackmail the Reunited Nations. In turn, they would hate us, if we did this terrible deed, no matter how idealistic our motives, no matter how idealistic our eventual goal."

"No," The Expert argued. "It would never come out. Only a handful of us would ever know that we Anarcho-Syndicalists had blown Island One. There would be none left alive, including our pilot of the Shuttle Craft, to report what had caused the explosion. It would seem an unexplained accident and the reaction would be to abandon the whole space colonization project. Billions of dollars would have gone down the drain and already almost a majority are protesting present expenditures. With such a tragedy, no more appropriations would be passed, and capitalism would be faced with its insurmountable problem, no more frontiers in which to expand."

They sat there for a long time looking at him. Finally, the chairman turned his eyes to one after the other of his companions, checking with them without need of words.

He turned back to The Expert and shook his head. "We cannot do it. Those up at Lagrange Five are members of the proletariat. Some are scientists, some engineers, some technicians, and some laborers, but they are all members of the working class. We could not bring ourselves to destroy them. Perhaps if we were right wingers, reactionaries, we could do such a thing. The history of the proletarian revolution is replete with such things as the decimation of the communards of the Paris Commune of 1871, of the White reaction in Hungary of 1919, of the fury of the Nazis in Germany, the Fascists in Italy and Spain, when they came to power, against us radicals. But we have been unable to retaliate in kind when given the opportunity. Perhaps it is because we have known such sorrow ourselves that we cannot find it in us to inflict it upon others."

The three seated flanking him nodded their approval of his words.

The Expert came to his feet, disappointment on his face. "Very well, Comrades," he said, "I suspected that this would be your reaction."

Without further words, he turned and left.

Outside the old grimy building

which housed the headquarters of the Anarcho-Syndicalists he stood for a moment, looking wearily up and down the street. He ran a tired hand over his features. The Expert had lied. He hadn't expected them to refuse him. Given their viewpoint, anything should have been acceptable to prevent the capitalist socioeconomic system from finding a new frontier into which to expand. This set his long-devised program back disasterously.

A voice next to him said, "What will you do now, Comrade?"

He turned. It was the girl.

"I don't know," he said.

"My name is Susan. There is a small autobar across the street. Will you join me in a beer?"

"Why . . . why, yes, of course, though I'd prefer a brandy. I'm not much of a beer drinker."

They crossed the street and entered the third-class automated bar, to find it nearly empty.

A few shabbily dressed men hunkered sadly over tables. They found as isolated a place to seat themselves as possible and Susan put her Universal Credit Card in the table's slot and dialed the two drinks.

The table top sank down to return with the beverages. They took them up and silently saluted each other before sipping.

Susan said, "Tell me more about this project to blow Island One of Lagrange Five, Comrade."

CHAPTER NINETEEN

Sophia Anastasis was seated at an ornate desk in the innermost office of the Baccarat Casino in the so-called last of the sin cities, Nassau. She was impatiently skimming through papers and ledgers. At the door, slightly to one side, stood the impassive Louis, her personal bodyguard, though in these days bodyguards were largely a thing of yesteryear, even in her circles. Over her hovered nervously the manager of the casino, which was the largest and the most opulent in the Bahamas.

She muttered, "Damned business red tape."

The door buzzed and she looked up in irritation and snapped to the manager, "I thought that we were to be undisturbed. I can't spend the rest of my goddamned life here. I've got to get back to New York. There are things going on there."

"Yes, Miss Anastasis. It could only be something quite important. I'll take care of it in moments—seconds," he said placatingly.

"Haven't you ever learned to delegate authority?" she said, her voice ungracious. She went back to scanning the papers.

The manager gestured unhappily to Louis, who opened up.

It was one of the casino's floor men and he didn't look any happier than the manager. However, it was to Sophia Anastasis whom he spoke, rather than to his immediate superior.

He said, "Miss Anastasis, something irregular has come up on one of the roulette wheels."

She glared at him as though he was

out of his mind, and then turned her indignation on the casino manager, her lips a bit pale. She snapped, "I came down here for our periodic quick spot check, not to handle every little detail of your small time operation!"

"Yes, yes, of course, Miss Anastasis." The manager glowered at his floorman. "What is the meaning of this intrusion, you insufferable ass?" The manager was island-born and had the British terminology.

But the floorman stuck to his guns and continued to address the corporation's official from New York. "Miss Anastasis, it's that Russian count you lifted the limit on the last time you were here."

"What Russian count, damn it?" she snarled. "I've met a thousand of them, all broke."

"Count Yaroslavl, Madam."

"Oh," she snorted. "Is Pavel here again? Don't tell me that you're having trouble with his credit. The story is that he holds half the gold in Switzerland."

"No, Madam. But you lifted the limit completely and for any occasion on which the count plays in this casino."

"Well, what of it, damn it?"

"Madam, he's playing with one hundred thousand psuedo-dollar chips."

Even the stoic Louis gawked at him.

"What do you mean!" the manager blurted. "We issue no such chips in this casino, and, as far as I know, no other casino in the world does."

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The floorman looked at him in despair, and said, "No sir. But he had the cashier issue him ten special chips on each of which was written, by hand, one hundred thousand pseudo-dollars. His credit immediately cleared in Geneva."

"A million pseudo-dollars," the manager said blankly. And then, quickly, "How's he doing?"

"He's winning, sir. He's been playing the *Tiers de Tout* system," the other said unhappily.

"Then he'll shortly be broke," Sophia Anastasis snapped, but she came to her feet, and tossed the pen she'd been checking with to the desk. That's all she needed, back in New York, to have an accounting come through indicating that as a result of her offhanded decision to lift the limit, some stupid Russian playboy, left over from the past, had dug a hole into the Bahamas operation amounting to millions.

She stopped momentarily at a mirror and did the feminine things, then growled to Louis, "Wizard. Come along, but goddamnit, stop being so conspicuous in public. You've been seeing too many of those prehistoric movie revivals of Humphrey Bogart and James Cagney, or whatever the hell their names were."

"Yes, Miss Anastasis," he said dutifully, following her from the office.

The gaming rooms of the Baccarat Casino were a deliberate, almost exact, copy of those of the Monte Carlo Casino, first inaugurated in the mid-nineteenth century, and for over a hundred years the most famous gambling house of the world. The decor, of course, was Victorian, and there was a lush opulence usually not to be found in the atmosphere where the rich frenetically try to lose their all.

From the swank *Salle Privée,* where the minimum chip was for one hundred pseudo-dollars, you could step out onto the terrace through French windows for a breath of fresh air, or, as the case might be, to blow out your brains after having lost the family fortune. From the terrace, the view of the Bahama beaches to the north and south was unrivaled and directly below one could look into the yacht basin and view the most luxurious boats and ships still to be found in the world.

Sophia Anastasis came up on Count Yaroslavl, who was in a jovial mood and playing red or black, odd or even, rather than numbers or groups of numbers. He had a stack of chips before him which made her inwardly wince.

"Pavel!" she exclaimed. "I had no idea that you were in Nassau."

He turned to her and beamed. "Sophia! And I had no idea you were here. Somebody, just recently, said you were in Macao. What in the name of anything can one do in Macao?"

"Ha," she said, adopting to his spirit. "Play fan-tan at the Central Hotel, the most ridiculous method of gambling in the world, and smoke Imperial opium. As though you didn't know."

He laughed, ignoring the most re-

cent spin of the roulette wheel. He hadn't bet. He said, "I will never forget you down there in the pit, wagering ten or fifteen cents, Hong Kong, at a time, with the coolies."

She laughed in turn. "It was some of the most exciting action I have ever had in my life. And remember, afterwards, that remarkable midnight dinner of roast pigeon at the Fat Sui Lau?"

And he chuckled again, juggling the half dozen chips in his hand. "Sophia, Sophia, I sometimes suspect that we are the last of the oldtimers, the gamblers who play for the fun, rather than the money. Who was the American gambler who pointed out that this was the only way? That if you were conscious of the money then you had a handicap?"

"Nick the Greek," she said.

"Yes. Before my time. I wish that I had known him. At any rate, my dear Sophia, you are ravishing tonight in that Crete Revival thing. The rumor has it that when you bought it you made arrangements with the Budapest dressing house to discontinue all its other offerings in the same line."

"Huh," she snorted, duplicating his flippant tone. "I am not quite that influential, Pavel." She frowned down at the table. "What in the world are you up to? Roulette is not usually your game, the odds being what they are."

He said, "After many a summer, Sophia, my dear, dies the swan. And I have finally figured out how to kill your swan. At least in this casino. I will try some of your others in Malta and Menton in the future."

She scoffed at him. "Pavel, Pavel, you eternal optimist. You have been trying long enough to know that there is no chance of beating the house—given time. What in the world are you doing down here? I thought you considered the Bahamas dull."

"I consider every place dull, Sophia, my sweet, except when you are there. I was up in New York this morning. Incredibly boring. So I took the rocket-shuttle down. I had devised this new system of mine."

A liveried waiter came up with a tray of champagne.

"Oh, preserve me," the Russian said. "Not Mumm's Crément de Crément I trust." But he took one.

"My own cellars," she told him. "What on earth were you doing in New York? And why didn't you look me up? I was there."

"How was I to know, my dear Sophia? I have been attempting to seduce you for years but you are always on the move. That is the difficulty with our set. It was boring, very boring in New York. No matter how one tries to cope, as the British say, one cannot delegate all of one's business affairs."

Sophia did her best to refrain from casting her eyes upward. She said, "Yes, laughable. But what in the world is this one hundred thousand pseudo-dollars a chip thing, Pavel?"

"I told you. My new system. As you said, if one plays long enough, no matter how lucky he may be, sooner

or later the house percentage gets to him."

He put three of his chips on black. "I forget where I was. I'll have to start a new run. Now, the way it works, I bet high enough so that I can make my killing, if luck is running with me, before the house percentage begins to be effective."

The croupier spun the wheel—the Baccarat Casino retained its Victorian atmosphere by not being automated—and even Sophia Anastasis watched in fascination. To her relief, the ivory ball dropped into a red slot. But the count immediately bet black again, this time with six of his special chips. And this time black hit and the croupier moaned softly, though supposedly he was neutral. Indeed, supposedly, he was plugging for the player, since, if a big win was made, invariably he was given a generous tip. But he was not alone. Sophia Anastasis also inwardly groaned. The bet involved six hundred thousand pseudo-dollars. She had been a fool to put no limit whatsoever on the Russian's wagers. But who would have dreamed that the playboy would have bet in this preposterous manner?

"Ha!" the count ejaculated. "We continue to win."

She had to rise to the occasion. "We?" she said, banteringly. "Do you mean you and me, or are you exercising the editorial we, or the royal prerogative? Since I am part owner of this casino, I cannot see where I am winning."

"Both," he said, more jovial than ever. "Did you now know that since the death of the Grand Duke Dimitri, I am the pretender to the Czarist throne?"

She managed to get out a deprecating laugh. "With fifty cents, a pretender to the throne of the Romanoffs can buy a cup of this new pseudo-coffee. How does the Soviet Complex view you?"

He jiggled his chips again. "Well, admittedly, not too favorably—if they have ever heard of me at all." He considered. "Now, let me see. I have won twelve chips. My next bet, given the *Tiers de Tout* system, calls for four as my bet."

More champagne had come and both took one, but inwardly Sophia Anastasis was freezing. Another four hundred thousand psuedo-dollars! And he was right. With bets of this magnitude, the house percentage didn't have a chance to operate. Out of seventy-three spins the house would win thirty-seven and he thirty-six, on an average. And she had enemies at New York headquarters who didn't like to see a woman in her position in the hierarchy.

The croupier came to her rescue saying, "I am sorry, but the bank at this wheel has been broken."

Sophia said to the Russian, "Let's go to my penthouse and have some more wine. You'll have to bring me up to date on recent developments. I haven't seen you for ages."

He was disgruntled. "I could move to another wheel. According to my system, I can play another dozen

times before house percentages, ah, louse me up, as you Americans say."

She pretended to be bored. "I have some excellent Beluga caviar on hand," she said. "Yellow Sterlet."

"You're jesting."

"No."

He looked at his chips and considered.

Sophia said, jokingly, "Besides, if we stay here you will undoubtedly win every penny in the casino and my colleagues will disown me." She wasn't too goddamned far from the truth, she thought inwardly.

He laughed, taken up with her banter. "I will tell you, Sophia. I will make a wager with you. Let me see." He rapidly estimated his chips. "I am into you somewhat more than a million pseudo-dollars. I will bet all of my gains against, ah, one desire that you grant me."

She eyed him in derision. "My dear, Pavel!"

"No, no. You know it is, ah, in the cards, as the American put it. We have been failing to, ah, get together, for years. Now a wager. If I win the next spin, then I can make one request of you. If I lose—it is yours to grant or not. In either case, my winnings are forfeit."

"You are mad!" she laughed.

"Yes, of course. For you. I have always told you so."

She said, "Very well, Pavel. You are most gallant."

He put four chips on the odd.

She flicked a hand at the croupier. They had been speaking in low terms so nothing of the conversation had been picked up. The house employee closed his eyes in pain but went through the necessary.

Pavel Yaroslavl won.

"My dear Sophia," the Russian said, "shall we check upon the authenticity of your yellow sterlet? In actuality, with the pollution of the Black Sea, I have not tasted it since my last visit with the Shah."

They left the gaming rooms, Louis trailing behind at a discreet distance.

The VIP penthouse of the Baccarat Casino was VIP indeed but neither Sophia Anastasis nor Count Yaroslavl seemed to notice the fact. Nor did the count seem to think it untoward that Louis entered behind them. Obviously, he was what he was, and a nobody. Throughout his life, the count seemed to project, such nobodies had hovered in the background. Louis seemingly disappeared into the woodwork.

Sophia Anastasis had worn a cobweb shawl, or rebosa, over her shoulders. Whether it had come from Nepal, Peru, or Yucatan was moot. But now she shed it. There was an ice bucket with a magnum of champagne on a side table, a spread of not only a wooden bucket of fresh caviar with all the necessities involved in correct presentation of Beluga, but also various other Russian zakuski, the Russian hors d'oeuvres, including smoked sturgeon sliced so thin as to be capable of being read through.

"Aiiii," the count said in admiration. "I had forgotten. One of these days, I shall defect back to the Soviet

Complex if for no other reason than to enjoy zakuski."

Sophia poured wine. "I doubt if you'd get it in a job involving filling salt shakers in Siberia. However, very well, my dear Pavel, you won your bet. Is it me, or Russian style delicatessen?"

He put a hand over his heart and pretended to be disconcerted. "You mean I must make a choice?"

She laughed at him. "I am going to, uh, love you to death. It was your wager."

"Was I worth a million pseudo-dollars?"

He took up the magnum bottle and poured into the two glasses.

"But, Sophia, my charmer, that was not the request I planned to make of you."

"What!"

"I won my bet, but I made no request that you come to bed. That simply, ah, seemed to naturally develop."

Infuriated, she sat up abruptly. "Throw this pig out!" she screamed.

The bodyguard shrugged his shoulders within his jacket and started forward smoothly, ruthlessly, and obviously without regret.

"Throw him out!" she screamed.

Pavel seized Louis by the jacket collar, hauled him to the door which led to the living room, pulled him through it, and dumped him there. Then, as an afterthought, he stooped and quickly disarmed the fallen bodyguard.

He turned, closed the door behind him, and tossed the weapon on a dresser top. He said to the wide-eyed woman in the bed, "You never know when these types might become excited and do something regrettable." He headed back for the champagne glasses.

Sophia Anastasis seethed.

Her recent bed companion brought over glasses of champagne and handed her one. She took it ungraciously, still obviously mad.

"How did you do that?" she snapped.

His eyebrows went up. "What?"

"Take that musclebound thug! You know damn well what I mean!"

"Oh. Well, my dear Sophia, you have a great deal to learn, in this regard, from the Orient. I sometimes suspect that they learned to incapacitate or kill with their hands in such countries as China and Japan because the man in the street couldn't afford weapons." He said gently, "I have still to make my request." He sipped and then added, "Sophia Anastasis has the reputation of never welshing on a bet."

"Damn you," she said. "I have never welshed, you bastard. What is this damned request?"

"I want the return of my uncle, Frol Alexandrov."

Her glare of indignation at him turned to puzzlement. "I've never even heard of him."

"I believe you have," he said gently. "He was kidnapped, in company with his lifelong collaborator, Professor

Wolf Gunther, by the mini-nuke extortionists."

"Your uncle!"

Sophia Anastasis, finished her wine, and turned to the TV phone screen. She activated it and said, "I want the dossier of Nobel Prize winner, Doctor Frol Alexandrov, immediately."

The screen relighted and Sophia Anastasis stared into it. Finally, she flicked it off again and turned to him.

"I'll be damned," she said. "He *is* your uncle."

"I told you so," he nodded. "My request is that he be returned to me."

"Why should I know how to go about that?"

CHAPTER TWENTY

Frank Turin was becoming irritable.

He said to the assembled newsmen—"How long does this go on? I haven't had any peace for days. If you'd leave me alone, perhaps I'd have the time to think of something that might be of assistance to the Professor."

"And Doctor Alexandrov?" one of the Tri-Di reporters said.

"Yes, of course." The young man was jittery. "I can't understand why the police haven't come. Surely this is a police matter. I had expected to be knee-deep in police officials, not media personnel."

One of the commentators said, "Surely, you've heard, Doctor Turin . . . it is Doctor, isn't it?"

"No," the other said grumpily. "I have yet to take my doctorate. As I told you, I am an assistant to the Professor."

The commentator said, "At any rate, the police aren't here because of the requirements set by the Extortionists. If the police show, all bets are off and those who have the mini-nuke threaten to use it."

One of the other newsmen stood and looked around at the others. He said, emptily, "I suppose there's nothing more, anyway, is there boys? Let's get going."

The balance of them nodded or grunted something, and they began to gather up their equipment.

One of the commentators looked down at Sissy Duff-Smythe, who sat a bit off to one side, a pen in hand and a notebook in her lap. His look was appreciative, and even a bit hopeful but he frowned as he said, "Haven't I seen you somewhere before?"

"Reuters," she clipped out, very British. "I do feature pieces usually." There was no encouragement in her voice.

He scowled for a moment, but nodded. "I guess that's it. We must have met in London. You wouldn't be in need of a lift, would you?"

"Thanks frightfully, but no," she clipped, and went back to her notes.

Within a few minutes, all had left save Sissy and Rex Bader. Some of the newsmen had had the courtesy to thank Frank Turin before leaving. Most didn't bother.

Rex tossed the notepad he'd been holding to a table. Sissy put her pen and pad into her shoulder purse.

Turin ran a weary hand over his chin and said impatiently, "What can I do for you two?"

Rex Bader said, "You can tell us where Professor Gunther and Doctor Alexandrov are."

The young man gaped at him.

Rex held his peace.

"I don't know what you're talking about!"

Rex Bader nodded. "We've considered that possibility, and, listening to you for the past couple of hours, I'm about convinced that you're telling the truth—as you now see it. However, there are some elements involved that indicate that you might know where they are and not know that you know." He added, "By the way, we are not news people. That was an excuse to get in. We're investigating the kidnapping."

He didn't bother to mention that he and Sissy were not official.

Frank Turin was staring at him uncomprehendingly. He said, his voice indignant, "The Professor was absolutely my best friend. To me, he is the most intelligent, the most . . ."

"We shouldn't wonder," Sissy said, in interruption. "And we're frightfully sorry he's been, uh, snatched. However, there are some aspects which it would seem you haven't considered."

"I don't know what you're talking about," the assistant repeated.

Rex edged forward in his chair. "Let's put it this way, Frank," he said. "We suspect that the Extortionists, as they call themselves, are backed by the Syndicate."

"The Syndicate! What do you mean, the Syndicate?"

"You know damn well what I mean," Rex said softly.

"Don't be ridiculous," the younger man snapped.

"That's what Sophia Anastasis said," Sissy told him. "However, it would seem, don't you know . . ."

"Aunt Sophia! What has she got to do with it?"

"Possibly nothing," Rex admitted. "However, I note that you call her *Aunt* Sophia." He fished the notepad from his pocket again and flicked through several pages. "According to your Dossier Complete, Frank . . ."

"My Dossier Complete! You have no right to investigate my dossier!"

"It seems that I have," Rex Bader said dryly. "At any rate, it reveals that the Turins are member of the Damon—the Americanized name of the family—branch of what was once called, if you'll pardon my language, the Cosa Nostra, the Mafia, the Syndicate, name it what you will."

"Don't be ridiculous!" Frank Turin blurted. "That was long ago. For that matter, I have no connection with the families. I am a student of science. I never even took the *Omerta* oath when I became a man."

Sissy said, "I don't twig that. The what?"

Rex looked over at her. "The code of honor and silence. Every Sicilian boy, of the Mafia families, takes it

upon reaching adulthood, if he, at that time, joins the organization."

"I am not a Sicilian!" Turin said indignantly. "I am a loyal American."

"Well, bully for you," Sissy said mildly. "But to get back to the point, we suspect that the Syndicate is back of the Extortionists. In fact, it has now become more than a suspicion. Didn't you hear the news this morning?"

"No. I haven't had time for listening to the news. These confounded news people are after me night and day."

"Dreadfully sorry," Sissy said. "However, old chap, somebody has evidently leaked the information to the media. The world has become more hysterical than ever. There is a revulsion against what once was called the Mafia. There are demonstrations everywhere. The public demands they be rooted out."

The young man's face went wan. "Would . . . would you like a drink?" he said. "I . . . I am sure that the Professor wouldn't mind."

"Damn well told," Sissy said.

Frank Turin went over to Professor Gunther's well stocked bar. He all but stumbled in his irritation and frustration.

Sissy looked at Rex. The student was obviously sincere.

He said, "Nothing about this makes sense. It is impossible that my people have anything to do with this horrible tragedy."

Rex took a pull at his drink and sat it down on the cocktail table between them and took up his notepad again.

He said, "We'll accept that you haven't consciously known about the whole thing. Nevertheless, this is what we have. You *are* a Turin, and, at least in the past, your family has been associated with the Damon branch of the Syndicate, a smaller branch, not affiliated with and certainly not as influential as that of Sophia Anastasis—your Aunt Sophia, as you call her. Now, some items have come up in this affair. One of them is the fact that much of the action has taken place in or near New Princeton. For instance, it was here that the mini-nuke was hijacked in turn from the original terrorist hijackers. Now, if you've followed the news at all, you'll know that all over the world, and particularly here in the United States of the Americas, efforts are being made to detect the presence of the mini-nuke. Teams of technicians and scientists are at every airport, every shuttleport, every underground ultra-expressway terminal, stationed along every ultra-highway, with equipment to detect the mini-nuke if its present possessors attempt to move it."

"That's nonsense," Frank Turin said impatiently. "It's too well-shielded to detect. That's one of its major properties. An untrained civilian could smuggle it into a major city, undetected."

Rex nodded. "Yes, you know that. And we know it. But the public doesn't know it and the Extortionists who have it can't be sure. Or, at least, we hope they can't."

"Why?" the younger man demanded.

"Because we hope that they are afraid to move it any considerable distance, for fear that it might be detected and rescued from them. So we are hypothesizing that they are afraid to move it any great distance from where they seized it, in New Princeton University City. Given that, when they decided to confuse the rest of us a bit by kidnapping a couple of nuclear physicists, they were inclined to pick a couple right here in this vicinity. Or, at least, Professor Gunther, who does his work here, and a close colleague of his, Doctor Alexandrov, who would come immediately upon being summoned by his close friend and collaborator."

The boy said dubiously, "The uranium they stole was way out in Idaho. They'd have to transport it all this distance, if this was where they were hiding out."

Rex shook his head. "They didn't really need that uranium. It was just a scare thing, to further cover their purpose. They've probably buried it somewhere out there in the wilds. But the mini-nuke and the professor and doctor are probably being held quite nearby."

With the drink that he had bolted down, Frank Turin had regained some of his composure. He said, "Granted that what you say is acceptable, what has it got to do with me?"

"Somebody had to finger the professor, Frank—We're thinking, and hoping, it was you."

"Don't be ridiculous!" But then, "Why me?"

"Because you're surely in contact with some members of your family who are still with the Syndicate. You also live with the professor, even though you're also still a student, as his part-time assistant. You could have dropped, inadvertently, the fact that he was a top nuclear physicist and then, gently milked for information, revealed where he lived, what his hours were, who one of his top colleagues—Doctor Alexandrov—was. And all the rest. Without even thinking about it, you could have given them all the information they needed to send that cable to Frol Alexandrov and set him up along with your professor. Then, knowing that your brother Tony lived in Arkham, they could have phoned you and gotten you out of the way. It had to be you who inadvertently fingered them, Frank. Nobody else fits."

The young man slumped back into his chair and his facial expression accepted what had been said. He blurted in despair, "But, what can we do now?"

"Figure out where they were taken."

"I . . . I don't know. How could I know?"

Sissy said earnestly, "Dear boy, we've already hypothesized that it's not too far away. Certainly, not more than a few hundred kilometers. It would have to be some place where there was some sort of hideaway where the professor and doctor

wouldn't be spotted. Where the mini-nuke could be hidden; where a small army of hoodlums could be stationed without arousing much attention."

Frank Turin's face went suddenly slack. He stood up and went over to the bar and poured himself a straight shot. He didn't look the type that drank more than a little.

He turned to them. "I know where they are," he said.

Rex and Sissy took him in silently.

He said, "When I was a boy, Tony and I were friends with Uncle Anthony's sons."

"Who in the hell's Uncle Anthony?" Rex said, leaning forward again.

"Anthony Damon. I haven't seen him for ten years or more."

"All right, wizard. That's a name we've come up against a couple of times. What's this place you're talking about?"

"Up in the Catskills. A summer home. Well, more than a home. Near a small town called Lake Hill. I used to go up there with Jimmy and Adam for weekends, sometimes longer. It was a wonderful place for hiking, fishing, all sort of boy things. That was before I became interested in science and . . ."

"Wizard," Rex said. "Why do you think they're there?"

"It has all the attributes you spoke of. It's isolated. It's only two or three hundred kilometers away. It's easily barred off from the public. What it amounts to is one large mountain house and then, about it, strategically located, another four smaller cabins. All sort of a complex. In all, it will house at least thirty persons. Well guarded. Uncle Anthony used to have gatherings there for both pleasure and . . . business."

"It's never been in the news? No publicity?"

"I don't think so."

Rex looked at Sissy, his face considering. He said slowly, "It sounds possible."

She said, "We'll have to get Jean-Paul and Ilya. Obviously, Mickoff and the IABI are out. They'd be afraid to participate."

He shook his head. "They might not show up at my place for a day or more. Who knows? I haven't the vaguest idea of what they're up to."

He sighed and took his Universal Credit Card from his pocket and put it into the slot of the TV phone which was on the desk beside which he had seated himself.

"Credit check," he said.

A mechanical voice said, "Seven pseudo-dollars and nineteen cents."

He stared at Sissy. "Wizard, I haven't enough credit to get us up there. Not to speak of getting back, if it's a false lead."

Frank Turin looked from one of them to the other. "What are you talking about?"

Sissy said, as wearily as Rex, "My American credit has been frozen. Rex doesn't have any on hand. We're operating under handicaps."

"I've got sufficient pseudo-dollar credits for any expenses involved in

rescuing the Professor."

Rex said slowly, "You mean you're willing to line up with us on this?"

"Of course!"

And Sissy said, "Righto. Do you have a gun?"

He looked at her blankly.

"No, of course not," she said. "And I assume you wouldn't know how to use one, even if we could scare one up for you, and I doubt that we could."

Rex said, "We don't need you, Frank. This is a job for professionals, and we're pros."

Frank Turin flared. "The professor's life is at stake. Besides, you don't know the setup. I do. I roved all over those hills, through those woods. You couldn't get near enough to the main house to make any difference without being shot, if they're really there, and Uncle Anthony has some of his people there."

"Wizard," Rex said in resignation. "The three of us, one of whom doesn't know a firearm from his elbow, will take on the last of the Syndicate—now known as the Extortionists."

Sissy came to her feet and said, "Let's go back to the apartment in the hopes that either Jean-Paul or Ilya will turn up by morning. Perhaps both of them will. That would make four of us, armed."

"And if they don't show up?"

"We'll have to go in alone."

CHAPTER TWENTY-ONE

When Ilya Simonov stood before the door of Sophia Anastasis' suite in the Diversified Industries Building his eyes went up slightly at the green stone inlaid there. He peered at it a bit more closely and murmured, "Well, Imperial Jade. And would seem to be from Burma. How ostentatious can you get?"

He had seen no indication of identity screen, nor any other electronic device, but the door swung open, and he nonchalantly entered and looked about. It was his first visit.

The living room was exquisitely done and quite empty. He was mildly surprised. Not even a servant? And, in Sophia's case—a bodyguard?

A voice from an inner room called languidly, "In here, Pavel."

He sauntered into the bedroom of Sophia Anastasis. She was propped up on pillows, having her breakfast.

He took up a chair from one wall, and examined it critically. Louis Quatorze, by the look of it, and by no means a copy.

She said coldly, "I've been investigating you. You're one of the best known figures in our so-called set, but there are strange angles. You appear at Hong Kong, you appear at Biarritz, in the Argentine, here in New York, in Paris—wherever. But then you disappear for as long as six months at a time and nobody sees you. You come and go. You're linked with this celebrity or that, passingly, but there is no record of marriage, ever, or even a lasting relationship. Your Dossier Complete is shockingly lacking in detail."

He put back his head and laughed again. "My dear Sophia . . ."

"Shut up. Frol Alexandrov isn't your uncle. In fact, we can't find any record of any living relatives of yours, my dear Count Pavel Yaroslavl, or should I say Ilya Simonov."

He raised his eyebrows at her.

She said, "Somehow—you were able to get into the National Data Banks, and have made some changes in the records about Alexandrov. However, you must have been pushed for time. They don't stand up. Besides, there are no equivalent records in the Common Europe Data Banks nor the International Data Banks. I doubt if Doctor Frol Alexandrov ever heard of you. Now, what in the hell do you want with me?"

"In the past century, my dear, various Russian scientists have fled the Soviet Complex and sought refuge in the West. Prominent among them is Frol Alexandrov. I would be less than a Russian patriot if I was not distressed at his kidnapping. One with my resources does not find it overly difficult to have, uh, alterations made in data banks. I thought that my story of Frol Alexandrov would be more acceptable to you if I claimed him to be my uncle."

"I don't believe you," she said finally. "I don't know what your game is, but that story doesn't ring true."

He shrugged, as though it was of little importance. "Tell me where he is, I'll go and get him myself. It would save you the trouble."

"What trouble? You seem to think I have him in my pocket."

"My dear, haven't you been listening to the news?" he taunted.

She turned abruptly and slammed a switch on an instrument next to the bed. "Give me a brief of recent news developments." she snapped.

She ignored him, seemingly not paying any attention to the fact that it was to him she was speaking, "Do you know what's happened? Someone has revealed to the news media that the so-called Mafia is behind the Extortionists."

"Sounds like The Expert at work again," he murmured.

She went on, enraged. "For a century we've been trying to upgrade our image, outlive that stereotype profile. Everything has been directed at legitimizing our projects, our operations. And now that stupid sonofabitch Damon has blown it all.

"I want Cesare Agrusa, Mariano DeLuca and Pasquale Santino! Get them on a scrambler and on a three way. This is Crash Priority!"

Ilya Simonov winced.

"Get the hell away from here," she snarled at him.

Into the phone screen she said angrily, "Pasquale, Cesare, Mariano. We're in the clutch. You've undoubtedly heard the news. Antonio Damon has gone out of his mind. We're putting a contract out on him. Like the old days. Him and his whole family. Put every soldier you've got into the field. Hit him! We've got to finish him and retrieve that mini-nuke and return it to the Reunited Nations."

"My dear Sophia," he said gently.

"You say you have never welshed on a bet. "Very well, I still want to know where Frol Alexandrov is."

She glowered at him. "I think I know, you wretch. Do you want to come along?"

CHAPTER TWENTY-TWO

The Expert was stretched out in bed, his hands behind his head, his eyes seemingly seeing far beyond the ceiling of the motel room on which they were trained.

Susan, her short, dark hair a contrast on the whiteness of the pillow, looked over at him. Even at dawn's early light there was a sullen quality in her face.

She said, "How long have you been awake?"

He looked at his watch. "I don't know. Are you sure that your people will be there, exactly on time?"

Susan didn't answer that directly. She said, "I'm the leader of the younger element in the Anarcho-Syndicalist movement here in North America. They do anything I say."

He nodded and continued to stare upward, his expression completely empty.

She said, "I've been thinking over that little story you told the National Executive Committee when you first came with your letters of introduction.

"I was born into a third generation radical family. One of my grandfathers had belonged to the Knights of Labor, the other was a Wobbly. My mother was a Debs socialist and my father was a DeLeonist."

"Ummm," he said absently. "I was born into a radical family myself."

"So you mentioned," she said. "Once, when I was about four years old I came to my parent and said, 'Mother, who is Comrade Jesus Christ?' You see, in that home I had never heard of anyone who wasn't called Comrade."

The Expert chuckled dutifully.

She went on. "I had two brothers, but I was the only one of the kids that remained in the movement. They rejected all of the blood, sweat and tears involved in being a radical. They decided that idealism was all very well but that they were out for number one."

He frowned over at her, not understanding what she was getting at.

She went on. "In short, though they were raised in the same atmosphere I was, they both became capitalists and identified with the present socioeconomic system."

"I see. What you are saying is that I am not necessarily a member of the movement."

She looked at him. "How did you know where the Extortionists have hidden the mini-nuke?"

His eyes narrowed imperceptibly. "I can't tell you. You're being foolish, Susan, and it is too late in the game for that. Within hours we move in to capture it. We've planned it all out in detail."

She said wearily, "There's only one way in which you could know, John Smith. You were one of the Extortion-

ists. You're either a member of the Mafia yourself, or you allied yourself with them."

"Don't be silly, Susan."

"Probably, the latter. I have followed the whole story of the stealing of the mini-nuke. It became rather obvious that those African terrorists had to have some inside help in order to have hijacked it in the first place. And then, later, it became obvious that the Extortionists had to have someone among the terrorists to betray them. And now, in turn, there must be someone with the Extortionists to betray them, if the mini-nuke is to again change hands."

He laughed at her, in scorn. "And what possibly could be my motivation for all this treachery? You don't make sense, Susan."

"That's what we haven't been able to figure out. What it is that motivates you."

He stared at her. "Who's we?"

"The National Executive Committee of the Anarcho-Syndicalist International."

He continued to stare at her and said finally, "You mean that all of this time they've been privy to the plans you and I have made?"

"Yes. They sent me after you to find out more details of just who you were and what you were up to."

He said bitterly, "And to accomplish this, you were even willing to climb into bed with me?"

"Yes. I'm a dedicated Anarcho-Syndicalist. I am quite willing to do anything for the cause. I thought that perhaps if we became . . . more intimate, you might let down your barriers a bit more.

"The *agent provocateur* is one of the oldest institutions used against radicals. We were afraid that you had been sent to attempt to destroy us and we wanted to find out just what you were up to."

"I see," he said icily. "And the young comrades you introduced me to, and I armed and informed where the mini-nuke is located. They don't really plan to be at the rendezvous point where we were to meet them this morning?"

"No. They won't be there. And your guns have been thrown into a lake. Anti-Anarcho-Syndicalists propaganda to the contrary, we don't advocate force and violence."

He was glaring frustration at her. "And what do you plan to do now?"

She shook her head. "Nothing. All has been done."

"*What?*"

"It was difficult to get through to the highest echelons. In fact, we never did get through to John Coolidge. But we did get our message to one of his assistants, a John Mickoff."

"What did you tell John Mickoff!"

"The location you gave us of the mini-nuke."

He was still glowering at her. Suddenly, he spun on his heel and hurried from the room, without another word, slamming the door behind him.

CHAPTER TWENTY-THREE

Cecila Duff-Smythe and Rex Bader

woke up simultaneously, and Sissy, for the moment, had to orientate herself.

She saw that Rex was awake next to her—up against her, might be the better term, in view of the dimensions of the bed—and said to him, "Don't you people jolly well get claustrophobia in places like this?"

"Yes," he said sourly.

He got up on his elbows and looked around the narrow confines of his home. "Well," he said. "No Jean-Paul and no Simonov."

"Yes," she said unhappily. "Neither have called in. We could have used that Russian one-man blitzkreig, in particular."

He looked over at her. "What happened to all the animosity you had against our commie friend?"

"Ilya explained the whole thing," Sissy said.

"He explained what?"

"My brother's death."

He rolled over to his left elbow and took her in. "Oh, he did, eh? I thought you said that he killed your brother."

She said, "I thought he had, but it seems that I was mistaken. Robert died in Ilya's arms."

"*He* told you that?"

"Yes."

"You believed him? I wouldn't believe him if he told me it was raining. I'd look out the window to double check."

"I say, very funny. However, the story made sense. They were both on assignment in Nigeria, both on orders to thwart a local attempt by some crackpots to establish what they called communism."

"Are you drivel-happy? What would Simonov be doing containing an attempt of communists to take over a country such as Nigeria?"

"It seems that the powers that be in the Kremlin finally arrived at a decision that should have come to them almost a century earlier. Socialism, or communism—Marx and Engels used the term interchangeably—presupposes a developed capitalism before it can be inaugurated. You can't have socialism until capitalism has performed its destiny, that is, achieved a highly industrialized society."

"Wizard," Rex grumbled. "What's that got to do with Simonov and your brother—Robert, didn't you call him?—being on the same side?"

"It would seem to be poor policy for the Soviet Complex to come right out and say it, but they can see little point in coming to power in the really backward nations. These simply haven't achieved to the point where socialism or communism is as yet practical. The more sensible thing is to allow them to go through the throes of capitalism, as they think of it, for a few decades, or whatever, until they have been industrialized. At least, that's Ilya's story. Angola, a couple of generations ago, is an example. Supposedly, the Marxists took over. But the thing was, basically the country was still tribal. Most had never even heard of such things as democracy, capitalism, socialism, or communism. Tribal society is largely feudalistic, there.

They simply weren't ready for a Marxist society—even given the Marxist view, which I, of course, don't have."

"All right, wizard. Let's skip the lecture on political economy. What happened?"

"Ilya was sent in to cool the talk about establishing socialism. Robert was too, but from the West, rather than the Soviet Complex, and not knowing about Ilya's mission. The local hoodlums, masquerading under the aegis of radical socialism, took exception to their efforts. There was finally a shoot-out. Ilya and Robert were the sole survivors and the Nigerian rebels had almost surrounded them. Robert was hit."

Rex grunted and looked at her sceptically. "Originally, you thought that Simonov had shot your brother."

Sissy nodded. She said lowly, "He did. He told me so."

She said, "Bob had taken a belly wound. He didn't have a chance of survival without proper medical care. The natives were coming in fast, there were only moments. Robert didn't want to fall into their hands. Most of them were out of the bush, and . . . well, were quite primitive. And they had their women camp followers with them, and you know the old tradition about not letting the women get to you if you become a prisoner of . . . savages. So . . . so Ilya responded to his request and . . . finished him."

"Damn it! Do you believe that? We've seen the way that Ilya Simonov finishes off anybody he's had it out with. You were the one complaining about his not taking prisoners."

"Robert sent me a last message—through Ilya. It couldn't have been manufactured. It came down from our childhood. He told Ilya that if he ever came in contact with me, to repeat it."

"A message! What kind of message?"

"You wouldn't understand. It was, 'Gremlin'—he always called me the gremlin—'I'm sorry I kicked Spotty'."

Inwardly, Rex Bader was disgusted with her. "Listen," he said. "Did it ever occur to you that your suddenly saintly Ilya Simonov might be The Expert?"

Her eyes widened. "No. Of course not."

"Well, consider it. He has everything we credit the Expert with. He's the most highly experienced combat man either of us have ever met. In his position as an espionage-counter-espionage agent, he probably has available all the inside information needed to pull the orginal hijacking, and, later, the second hijacking by the Extortionists. Where has he been, all of this time since we've been supposedly working as a team? He shows up periodically. For that matter, where in the hell is he right now?"

"For that matter, how do I know that you aren't The Expert?"

He made a rude noise. "For one thing, I'm not a trained combat man, as we've decided the Expert must be. For another thing, I don't think I've ever met a Third World Liberation

group member in my life. I've never been in any of their countries. For another, I haven't the access to the inside information The Expert seems to have."

"You have a Priority One-Nonmilitary to your National Data Banks."

"But I didn't get it until after that first hijacking! I no more had the dope about the route of that convoy carrying the mini-nuke than you had."

He glowered at her again. "For that matter, how do I know that you aren't The Expert?"

She laughed at him. "My dear chap, I'm a woman. No Moslem would take orders from a woman. Besides, I wasn't even in the country when the first hijacking took place. I was in London and can prove it."

"This is all a lot of curd," he growled. "I don't know why we're yelling at each other." He looked at his watch. "Frank Turin should be turning up. We're going to have to forget about help from Simonov and Jean-Paul and face up to doing it ourselves—if we can."

And then his face froze.

"What's the matter," Sissy said.

"Something you just said," he told her. "About the fact that I had Priority One on the data banks. The Expert simply *had* to have a great deal of secret inside information to plan that original hijacking."

He sat down at his desk and flicked on the TV phone screen. She followed him.

He put his identity card into the slot and his thumbprint on the identity square and said into the screen, "I am Rex Bader and I have a Priority One, save for military security information, in the National Data Banks."

A mechanical voice said, "Yes, sir. You have a Priority One-Nonmilitary rating."

"Very well," he said very evenly. "I want a complete list of every other person who has a Priority One in the United States of the Americas." He thought for a moment, then added, "Or anywhere else, for that matter."

Sissy was on the other side of the small room, so she couldn't see the screen when it flashed the material Rex wanted, but she continued to frown at him.

Finally, Rex reached out and deactivated the screen wearily and then slumped back into his chair.

"I say, what . . . what happened?" Sissy demanded.

Rex looked at her. "I know who The Expert is," he said.

CHAPTER TWENTY-FOUR

Rex Bader and Cecila Duff-Smythe were on their stomachs behind a boulder on a knoll overlooking a small wooded valley. Spread out before them they had a crudely drawn chart of the valley. Beneath them, about a thousand meters off, set into the trees, was a cottage of logs.

Rex growled, "Where in the hell is that kid? He's been gone a quarter of an hour."

Sissy indicated the handmade map. "If he's checking out all four of those cabins, not to speak of the major

house, in the middle, it's going to take some time. Especially since he has to keep from being seen. And remember, he hasn't been here since he was a child."

"I wonder what in the hell they'd do with him if they did catch him," Rex grumbled. "He's not even armed."

"It's probably better that he isn't," she said. "As it is, he's a relative of Damon's. They certainly wouldn't shoot him."

"With a billion dollars at stake, and they caught him prowling around without any reason?" He added, meaninglessly, "Damn it." And then, "we shouldn't have let him go."

"Suppose I take a look at that bloody cottage down there," she said gamely.

"Don't be drivel-happy," he told her, his voice just short of being nasty.

She shrugged. "We can't stay here forever, and Frank's been gone now for over twenty minutes."

"I'll go. There hasn't been any signs of life down there. Possibly the cabin's empty. Or possibly they're still all in bed. Probably they're all city types and not used to getting up early."

She shook her head. "No. I look less suspicious. I'm a woman and I'm dressed in tweeds and hiking shoes. At worst, they'd tell me I was trespassing on private property and to buzz off, I shouldn't wonder. I'd look simply like a tourist hiking around in the woods."

"We'll both go," he said unhappily.

"No." She was patient. "One of us has to stay here for Frank's return. Otherwise, he wouldn't know where we were."

He was frustrated but said nothing when she came to her feet. After all, he told himself, she was a highly trained Scotland Yard operative. She made her way off into the trees and was shortly out of sight."

"Damn it," he said again, under his breath.

As more time passed, he continued to peer at the log building and its immediate vicinity, trying to catch her stealthy approach, without success. He wished that he had been able to bring binoculars. The trouble was, he didn't own any and had insufficient pseudo-dollar credits to buy a pair. He should have thought to have Frank Turin order them when the professor's student-assistant had come to the apartment earlier this morning.

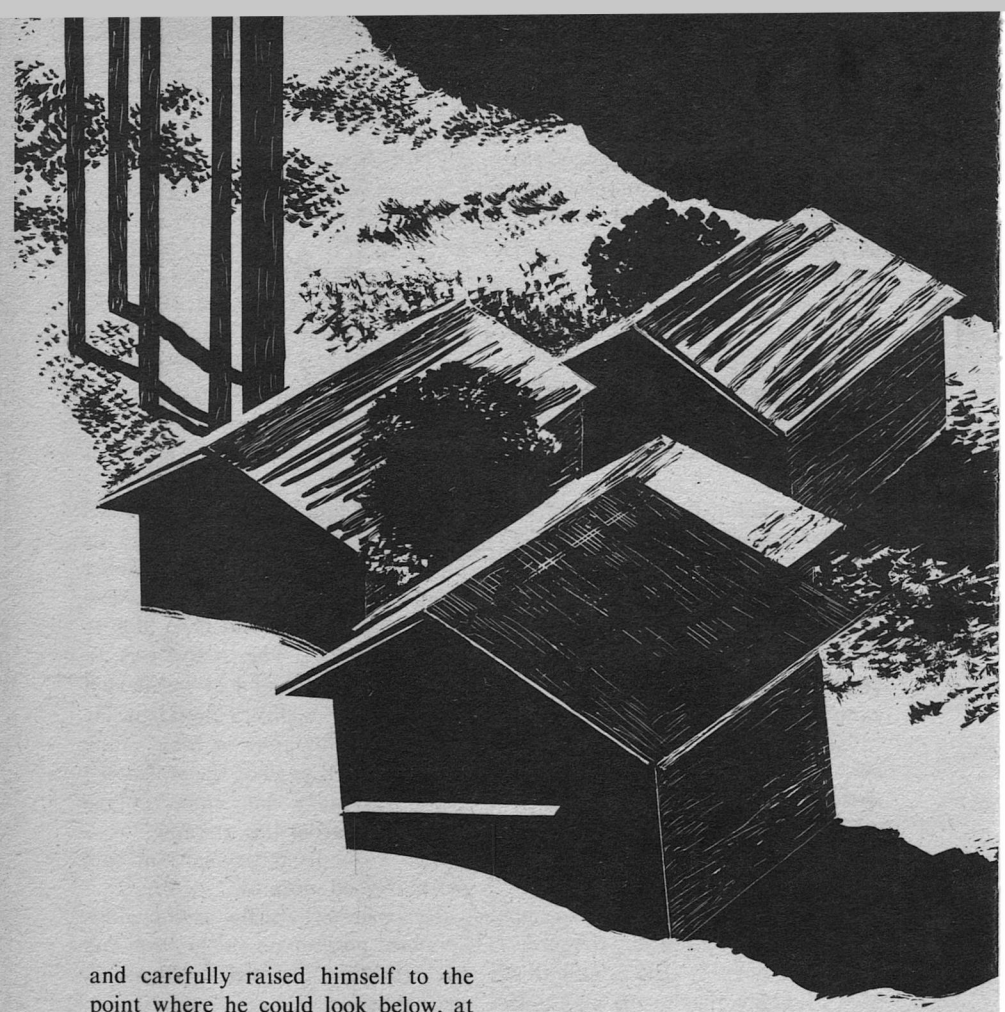
The voice from behind him said softly, "Good morning."

Rex spun awkwardly, in view of his sprawled position on the ground, and his right hand fumbled for his shoulder holster.

Ilya Simonov said, "Gently, gently." The Russian, who had obviously come through the woods behind Rex, was standing there nonchalantly.

"How in the hell did you sneak up on me so easily?" Rex demanded in irritation. "And how'd you know I was here? And how'd you find out about this place?"

The other stooped somewhat and came closer. He got down on one knee



and carefully raised himself to the point where he could look below, at whatever it was that Rex had been observing.

He murmured, "You wouldn't last an hour in jungle warfare, my friend. But I didn't know you were here. It was a matter of stumbling upon you. I was scouting out the vicinity. I like to know my route of escape. So far as how do I know about this place, it's a long story, which I'll tell you later. But why should you be surprised? It's our job, isn't it, to find the mini-nuke? Why should I be less successful than you?"

Rex snorted and said, "We were brought here by Frank Turin, Professor Gunther's assistant. He used to vacation at this Mafia hideaway when he was a boy. He's off scouting

around for us down there."

Simonov looked over at him. "Who is we?"

"Sissy and I, of course."

"Where is she?" Simonov said.

"The boy hasn't returned so she decided to take a look at the cabin down there."

"Damn!" the Russian blurted. "How long has she been gone. All hell's scheduled to break loose in no time at all."

"Ten minutes or so. What . . . ?"

"Stay here," Ilya said urgently. "I'll go get her."

"I'll come too."

"You can't. Somebody's got to wait for your guide, and he doesn't know me."

The Russian was gone, disappearing into the woods even more stealthily than Sissy had.

Rex cursed unhappily and, helplessly, returned to staring at the cabin. The minutes dragged on. He could see neither Sissy nor the Russian agent.

Two shots rang out from the rustic little house. He was instantly on his feet and dashing down the hill, dragging his Gyrojet pistol from its holster.

He made no attempt at cover, stealth nor silence but slammed toward the front door. From ten feet off it looked as rugged as that of a prison cell and he cocked his left shoulder and banged into it, bringing to bear his full weight. Only at the last moment did he realize that the door was already a fraction of an inch open.

He burst into the cabin's living room, stumbling, his gun in hand. There were two men sprawled on the floor, another on a couch, to which he had obviously just been lifted. Sissy was bending over the one on the couch, her face drawn. She was tearing at the man's shirt, obviously frantically trying to get at a wound. Ilya Simonov was standing to one side, his face wolfish. On Rex Bader's entrance, he shrugged his laser pistol back under his jacket.

Rex looked about blankly. There were several guns, ranging from a rifle with telescopic sights to a machine pistol, on the floor. A heavy automatic was still in the hand of one of the deceased.

Rex Bader blurted at the Russian, "You mean you broke in here and took on three men and aren't even nicked?"

The Russian laughed without humor. "Their backs were all turned. There were busy with, or about to become busy with, Sissy. Ah, that is, Lady Duff-Smythe."

She looked up at him, her eyes shining. "Sissy," she said, "Ilya." And then, with a sigh, "This one is dead too."

From not too far away, a couple of rifle shots rang out. Rex's first reaction was to think of the possibility of deer, or possibly squirrel hunters, but then came a lasting and blasting firing indicating full-scale battle and that ended that idea. One does not hunt deer with machine guns.

"What in the name of hades is that?" Sissy snapped.

The Russian smiled grimly at her. "That, I assume, is your friend Sophia Anastasis remonstrating with some recalcitrant Mafia family members." He added, at their stares, "It seemed to me the better part of valor to drift away from the scene of combat until they had, ah, wiped each other out, as the Yankees would say, to whatever extent possible."

Rex said accusingly, "Where in the hell's Jean-Paul?"

"I suspect, right in the middle of that," the Russian told him. "It would seem that the mini-nuke and the two kidnapped scientists are in the main housing complex."

Rex Bader said, "Let's get over there before whoever wins takes off with the damned thing again."

"My hero," Sissy said, heisting up her skirt and bringing forth her hid-

den Gyrojet. "You weren't here to protect my honor, but now you want to break in on the last of the Mafia gang wars. However, let's go. I didn't have time to get this into action earlier, now I'll have it in my hand."

The increasingly heavy sounds of shooting had come from the direction of the back of the cabin and possibly from as much as half a kilometer away. They hurried through the rear door.

The three didn't have breath for talk as they sped in the direction of the combat. And even as they progressed the volume of fire was falling off.

"Short and sweet," Ilya murmured.

"You forgot to say, as the Americans say," Rex puffed.

By the time they approached the lavish central buildings of the Mafia hideaway complex, the firing had dropped off completely but they kept their guns in hand and spread out, ten meters between them, to avoid making a single target for some gunner. All three were crouched as they ran, in an effort to present as small a target as possible when going into fire.

As though rehearsed, when they reached the front door, Sissy jumped to one side and pressed against the wall, gun extended, and Ilya Simonov duplicated her maneuver to the other side. Rex Bader, who had been in the center of their trio, kicked the door violently and dashed in, Gyrojet at the ready. He immediately bounded to one side and winged a double shot at the sole occupant of the reception hall in which he found himself. The man crumbled, with a complete lack of comprehension washing over his face, and his submachine gun dropped to the floor.

Rex realized, now, that the other had already been hit before Rex's two rocket slugs had finished him.

He yelled, "Clear!" His two companions darted through the door after him, and, in spite of his words, their guns swept the hall, seeking out targets.

"Let's go!" Sissy yelled, and they headed down the hall. Doors ahead indicated a living room.

The living room, once luxurious, was now a shambles. Rex Bader was reminded of the scene before the student apartment of Alioune Senghor, following the concentrated gunfight there. Indeed, if anything, there was more wreckage, more debris—and more fallen. There were five or six dead or badly wounded in the living room, most of them near the French doors, two more sprawled out on the terrace beyond. They had seemingly given their lives desperately; the floors were strewn with ejected shells of a half dozen different calibers.

Rex and Ilya checked out doors and windows. For the time, the vicinity seemed devoid of any but dead or wounded.

"Give me a hand here," Sissy snapped.

They turned back to where she was bent over one of the fallen.

It was Jean-Paul. . .

"Get him to that lounge," she said urgently and they complied, the Russian taking the shoulders, Rex the feet.

And for the second time in the past half hour, Sissy bent over a dying man and did what she could.

The Frenchman looked up at them, breathing deeply. "Where's Mickoff?" he got out. "He should be here by now. The team is not complete." He looked up at Ilya Simonov. "How did you know?" he said.

The Russian said softly, "I've suspected since the affair when the Extortionists seized the bomb from the terrorists. When Nayef Habash revived, there in the hall, he grabbed up a gun and shot you, although I was the one he should have fired upon first, since I had gun in hand and none of the rest of us did. And as he shot, he screamed in Arabic that you were a traitor. Later on, I was suspicious of that kidnapping of yours from which I supposedly rescued you. It was a little too pat. I suspect now you were simply being taken to the Extortionists for a conference . . ."

The Interpol man nodded, weary. "I should have suspected that you spoke Arabic."

Ilya said, "You also let your sense of humor betray you, when you copied my use of the term Expert. Only we here now could have known the term and applied it to our mysterious mercenary. It had to be one of us, or Mickoff. I knew it wasn't me, and it couldn't have been a woman, so that left you, Mickoff, and Bader. Mickoff seemed unlikely, and Bader had no combat training, according to his dossier."

Jean-Paul looked at Rex. "Did you know too?"

"Not until early this morning." Rex told him. "It was obvious that The Expert had a high priority rating in our National Data Banks. I checked and found that you had the same non-military priority as I did. They had evidently issued it to you as top Interpol liaison man to the United States."

Sophia Anastasis came striding into the room. Behind her, were two young toughs, both carrying short, efficient submachine guns, and they were at the ready.

Sissy, Rex, and Ilya Simonov had been too taken up with their talk with Jean-Paul. Now, Rex looked pained, and the Russian disconcerted, at being allowed to be surprised. The wolfish expression on Ilya's face indicated he was considering going for his holstered weapon.

Sissy, alone unfazed, said to him out of the corner of her mouth, "I say, cut it out. You'll get us all killed."

Sophia Anastasis stared down at Sissy. "Let the sonofabitch die," she snapped.

Suddenly, there were shadows swooping in, and the noise of aircraft. Rex went to a window and peered through shards of glass. He announced, "Helio-jets."

"The United States Cavalry arrives a bit late." Simonov chuckled.

analog

A Calendar of Upcoming Events

2 December 1977
British Interplanetary Society Lecture Series—Exploration of the Planets: The Earth. At Kent Room, Caxton Hall, Caxton Street, London S.W.1, England.

5-7 December 1977
Winter Simulation Conference (NBS) at Gaithersburg, MD. Info: Meetings Inquiries, I.E.E.E., 345 East 47th Street, New York NY 10017.

5-7 December 1977
Alternate Energy Sources: A National Symposium at Miami Beach, FL. Sponsored by the Clean Energy Research Institute. Info: T. Nejat Veziroglu, Clean Energy Research Institute, School of Engineering and Environmental Design, University of Miami, P.O. Box 248294, Coral Gables FL 33124.

8 December 1977
I.E.E.E. Conference on Decision and Control at New Orleans, LA. This includes the Symposium on Fuzzy Set Theory and Applications. Info: Meetings Inquiries, I.E.E.E., 345 East 47th Street, New York NY 10017.

30 August-4 September 1978
IGUANACON (36th WORLD SCIENCE FICTION CONVENTION) at the Hyatt Regency, Phoenix, AZ. The major meeting of the Science Fiction Universe. Guest of Honor—Harlan Ellison; Fan Guest of Honor—Bill Bowers; Toastmaster—F. M. Busby. The Hugos (SF Achievement Awards) and the John W. Campbell Award for Best New Writer will be presented. Talks, panels, films, masquerade, art show are among the events. Registration $15 until 31 December 1977; $20 until 31 July 1978; $25 thereafter and at the door. Join early so that you can nominate and vote for the Awards. Info: Iguanacon, P.O. Box 1072, Phoenix AZ 85001.

—ANTHONY R. LEWIS

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

Sophia Anastasis glared at him. She turned to her two gunmen. "Get around quick and tell the men to drop their arms, preferably someplace they can't immediately be seen. When the fuzz comes up, have them put their hands on the tops of their heads, obviously surrendering. Under no circumstances is there to be any resistance."

The boys, as she called the two well-dressed goons, dropped their own guns and took off.

"Where's the mini-nuke?" Rex said to Sophia Anastasis.

"Upstairs, shot into fragments," she said. "That's the last of that damned thing. The three scientists are there too, all okay, thank God."

Sissy said, "*Three* scientists?"

"Alexandrov, Gunther, and one of my nephews, Frank Turin. We picked him up sneaking around in the woods, just before we mounted the attack."

"Where's this Damon character?" Rex said.

"Dead, the stupid bastard. They're all dead. We couldn't afford to leave any of them in shape to stand trial. If we had, it would have stretched things out in the public's mind. Now, possibly, it will all die away—people's memories are short." The Diversified Industries leader glared down at Jean-Paul Lafitte. "What in the hell did you have in mind?"

He got out, "Just that. The fact that the people's memories are too short."

Through one of the French windows, came John Mickoff, gun in hand. Immediately behind him were two of his agents, assault rifles at the ready. And behind them, John Coolidge.

While the two agents took in the wreckage of the room and then bent over two of the fallen who showed faint signs of life, John Mickoff eyed the team, including the badly wounded Jean-Paul Lafitte.

He said to Rex, "Younger brother, you've been at it again. What in the hell happened?"

Rex told him briefly. "The mini-nuke's destroyed. Professor Gunther and Frol Alexandrov are upstairs safe. Damon's dead, and so are all of the Extortionists."

"You accomplished all that?"

"No," Sophia Anastasis said, "I did, damn it. It was the only way to clear our organization. We rescued the mini-nuke, and the kidnapped scientists, and we finished off the Extortionists. I demand a statement to the news media that Diversified Industries collaborated wholeheartedly with the IABI in the whole affair from the beginning."

"You're in no position to demand anything . . ." Coolidge began.

"Like hell I'm not," she snarled. "If you don't issue such a statement and immediately turn loose all of my people—I assume your agents are now rounding them up—I'll reveal how inept the IABI has been, and that actually we, on our own, finally tracked the Extortionists down, without your aid."

Coolidge glared at her for a long

moment. He fiddled with his pill box, and took two of his tablets without benefit of water. Finally, he turned to the two armed operatives. "Get out and tell the men to release all of Miss Anastasis' people. It seems that she had been cooperating with us all along."

"I'll go with you," Sophia snapped. "I want to be first to get to any news media people you have along."

John Coolidge looked after her thoughtfully for a moment, then pushed himself from the chair. "I'd better be there," he muttered and took off after her.

Sissy said to John Mickoff, "Do you have any medics with you? Jean-Paul's in a bad way."

He stared down at the Frenchman and shook his head. "They're coming up in a second wave of aircraft, along with the news people. We didn't know what we'd run into. They should be here in about ten minutes."

"Too long," she said.

"Ummm," Ilya Simonov murmured. "We figured him out, but I'm a bit surprised that you did." He cleared his throat. "And now I had better leave. It's going to be difficult enough for you to explain how you needed the, uh, Mafia to bail you out without any sharp reporter recognizing me."

John Mickoff began to say something to the Russian, but then shook his head, and Ilya turned and left, heading for the front door.

All eyes went back to the dying Jean-Paul Lafitte.

Sissy said softly, "What did you mean, people's memories are too short? What motivated you, old chap?"

He took as deep a breath as he could manage and got out, "Isn't it obvious? Man has begun to colonize space and we haven't even solved our basic problems here on Earth. Would you like to see these problems taken out into the Solar System with us, and possibly beyond? We have socioeconomic systems, both East and West, that don't fully answer our needs. We have such extremes as terrorists who are willing to kill indiscriminately to achieve their ends. We have such powerful organizations as the new Mafia who are willing to do anything to acquire money. I thought that we even had revolutionary organizations willing to to do anything at at all to bring their systems to power. I seem to have been wrong, insofar as the group I tried to work with was concerned—but possibly there are others."

John Mickoff said flatly, "We are informed that you planned to blow up Island One of the Lagrange Five Project."

Jean-Paul attempted a small laugh which didn't come off. "That was nonsense. In the same manner I was attempting to destroy the terrorists organizations, and later the present day Mafia, I was going to turn over the mini-nuke in turn to what I thought were the most radical elements going. But there was no real chance of the mini-nuke being so used. I lied to them when I said I

could make arrangements to send it by stolen Space Shuttle to Lagrange Five."

Sissy said, still softly, "But Jean-Paul, more than a hundred people have been killed in these efforts of yours. Now you claim they were all altruistic."

"They were mostly terrorists, Mafia hit men," he said defensively.

"Most, but not all," Rex said, his voice grim. "Some were soldiers, some police, and some IABI agents."

The ex-Interpol man sent his eyes to him. "What are a handful of people compared to the billions threatened by nuclear warfare? They were expendable for the greater cause."

Sissy, Rex, and John Mickoff stared down at him. He was obviously mad in his obsession.

The Frenchman saw their expressions and stirred very slightly in agitation.

"Don't you see! Did you dream for a moment that if the United States disassembled the pilot model of the mini-nuke that it wouldn't surface again, to take its place with the other nuclear weapons?"

Rex was scowling at him. He said, "But Lafitte, what did you expect to accomplish with these hijackings?"

"To raise the human race to such a state of hysteria over the knowledge of the danger of nuclear weapons that it would at long last take the measures to end them. I wished to present them with one crisis after another. First terrorists were threatening to use the mini-nuke, then extortionists had it in an attempt to blackmail, then radical elements would take it over and threaten its use in an attempt to change the socioeconomic system. At long last, the people would be driven to destroy such elements as terrorists, and organized crime, and turn to the only real answer."

"World government?" John Mickoff said emptily.

"If we're going to end war forever—even among our eventual space colonies—we're going to have to do away with the anachronism of national states. We must have a true government of the whole race."

He was going out fast, every word was now an effort.

Sissy bent down over him. She could hardly make out what came now.

He whispered, "I failed. I didn't bring it off. I made mistakes."

Cecila Duff-Smythe looked up at Rex Bader, and John Mickoff. "He's dead," she told them.

"He was crazy as a bedbug," Mickoff said bitterly.

EPILOGUE

Sissy Duff-Smythe looked at Rex. "Well, I don't suppose you'll be staying here much longer."

"As soon as my job goes through, we'll get a suitable place."

She frowned unhappily, "We?"

He looked at her. "Yes, of course."

"Rex, I've applied again for my Scotland Yard position. After a short vacation I'm to fly back to London."

He was shocked. "But . . . but how about us, Sissy?"

She shook her head, her expression still unhappy. "I'm dedicated to my job, Rex. Besides . . . there's someone else."

"I see—it's that damned Russian, isn't it?"

"Yes . . . Goodbye Rex."

He looked at her numbly for a moment. It was his turn to shake his head. He took her into his arms and kissed her.

When he was through, she turned for the door.

He looked after her until the phone screen buzzed. He answered it, and the face of John Mickoff faded in.

Rex said wearily, "Hi, John. What spins?"

The IABI man looked at him with less than enthusiasm and said. "I've got news for you, younger brother," Mickoff sighed. "You want the good news or the bad news first."

Rex Bader looked at him in apprehension, "What's the good news?"

"The Chief was a damn fool to come on that expedition to Lake Hill where we recovered what was left of the mini-nuke. It was too much for that ticker of his, but he's always been keen to get in on any news coverage involving the bureau. He was a lens hog."

"Come on, come on."

"He's dead, younger brother."

"That's the *good* news?"

"Yeah. I know you didn't like him. Neither did anybody else, for that matter."

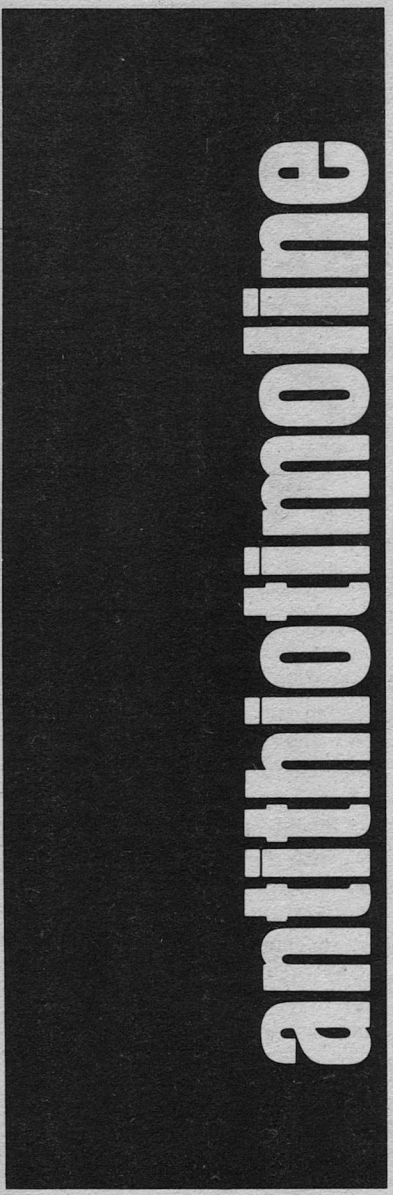
"What's the *bad* news?"

Mickoff said, "Sorry, Rex. He could have swung it. Nobody else in the bureau could. The computers don't clear your ability quotient as being eligible. In fact, you're lower now than you were a couple of years ago. You're older. The kids coming up are sharp. I'm just hoping I won't be spelled down, one of these days."

"Why, you bastards. That was a definite commitment!"

The other shook his head regretfully. "It was verbal, younger brother, and a personal promise. Sorry, maybe I'll be able to swing some expense pseudo-dollars for you . . ."

Even after Mickoff's face was gone, Rex Bader stared at the screen for long, miserable minutes. ■



On a clear day, you can see . . .

Cell D-1
Hayward State Prison

March 7, 1977

Director
CIA
Washington DC 20011
Dear Sir:

I am writing this letter to you as a last resort. Please don't take this as just another crank letter. I always thought myself to be idealistic, but I guess idealism dies when you're sitting on Death Row. It really was a case of temporary insanity, even if the judge wouldn't buy it. So, I'm offering to reveal my secret to you if you grease the necessary wheels to get me a pardon. A little dough to get me started again wouldn't hurt either, and even some influence to get me back into some decent research laboratory again (but working in some other area, please, where thiotimoline has never been heard of).

Oh, let me introduce myself properly. Although my address is now given above (temporarily, until they roll out the electric chair), I'm really a scientist, and a pretty darn good one.

Topi H. Barr

Specifically, I'm a PhD chemist, employed at Western State University. Full-professor rank; Department chairman; established, federally-funded research program (or, rather, it was, until emphasis on 'relevance' pulled the rug out from under me—in more ways than one.) Our Department wasn't MIT level, but we had some good people. Struggling, but I was pushing the Department (and myself) up the ladder. That is, until the night I went berserk. Killed my wife, they say and then busted up my lab. They caught me as I was headed out of the lab, muttering something about "I'm going to kill that dirty, stupid bastard." The jury didn't have much sympathy for us 'intellectual' types—neither did the judge for that matter. They threw the book at me, including the new law legalizing the death penalty. So here I am, with the press just sitting like vultures waiting for them to strap me in and start the juice flowing through the electric chair. The more I think about it, the less I like it. Would you?

So, why am I writing to you? I've made a discovery that will ruin civilization (or at least take all the fun out of it—as my wife found out). But it would be a fantastic boon for the CIA, at least as long as you can keep it a secret. Why do I bring it to you? Certainly not because I have any love for the CIA. Just the opposite. But I love my life, and you're the only ones who can bail me out of my predicament. In this letter, I'm going to tell the story of what I discovered, and why it got me into the awful mess I'm in right now. If you believe my story (and you've got to!), I'll make you a deal. You pardon me, and I'll tell you what you need to know to reproduce this phenomenon I'm going to describe to you. It's simple. Any technician can repeat it once the crucial steps are outlined. If it works—I go fancy-free. If not? Well, it will, so no need to speculate!

Where do I start the story? Well, as I said, the government saw fit, in its infinite wisdom, to cut off the funds supporting my research. Sound, basic stuff, that will lead to lots of new inventions in a decade or two. But that's not good enough for the agencies these days. They want practical results, and they want it now. So I had to look for other projects, and look quick. What with the state legislature on an economy kick, we can't afford to teach modern up-to-date undergraduate labs, let alone support expensive graduate research programs on state funds. While casting around for ideas, an article referring to some utilization of Issac Asimov's famous thiotimoline caught my eye. (You surely know what that is. I suspect its your group that makes certain it's well nigh impossible for common, ev-

eryday, ordinary citizens to lay their hands on any of it. In case you don't have the foggiest, its a beautiful organic compound which is so bloody sterically crowded that two of its hydroxyl groups are "extruded into the future". Thus, under certain conditions, it can be used to predict events before they happen. That's why I'm sure you guys are interested in it—and why none of the procedures work that are given in the literature for preparing it.) "Why", I said to myself, "if thiotimoline can be used to predict the future, can't we make a visual record of the future?" Once I asked the question, I saw immediately the way to go about making these photographs of future events. This surely was a 'relevant' project. I saw research dollars just flooding in from Washington.

First, however, I had to show that the idea was really feasible. Rule number something or the other of grantsmanship. Before you can get a grant to do something, you have to have already shown you can do it! Stupid bureaucracy. If I'd been at MIT they would have fallen over themselves to give me the money. But not at Podunk U. But where to get the thiotimoline to try the experiment? Without the federal grant (and the associated permit) I couldn't purchase it. It helps to be a big frog—even if you are in a little puddle. I went directly to the Master himself, and Asimov airmailed out 5 grams, pledging me to never breath a word of it to anyone, especially you guys. While waiting for it to arrive (and hoping it didn't end up in Timbuktu), I grabbed a second year graduate student and started setting up the experiment. It really was simple—just a matter of doing a little holography. A laser, a couple mirrors, etc., was all we needed. We ran the laser beam through the thiotimoline sample, bounced it off a mirror and back through the sample a second time, and produced the hologram. We made the first experimental run Oct. 26, 1976 at 2:13 PM. In the hologram, the calendar still said Oct. 26, but the clock said 4:39. We had a picture 2½ hours into the future. Success! Next we moved the mirror back an additional two feet from the sample and reran the experiment. Now the clock said 6:25. This time we were 4 hours into the future! We were on the gravy train. If you want more details, see my grant submitted to DOD—if you already haven't—and my patent application on producing movie pictures of the future. (Oh yes. If you're feeling generous when you pardon me, you might make sure that the patent office gives me an iron tight patent on that process. It would give me great pleasure collecting royalties from the CIA.)

So far I'm not in any trouble. But its not far coming, although I couldn't see it. I needed more thiotimoline, and without the grant I couldn't get it. So I sat down with an organic chemist friend of mine and started to bat around ways to synthesize the stuff in the lab. If you knew me, you'd know

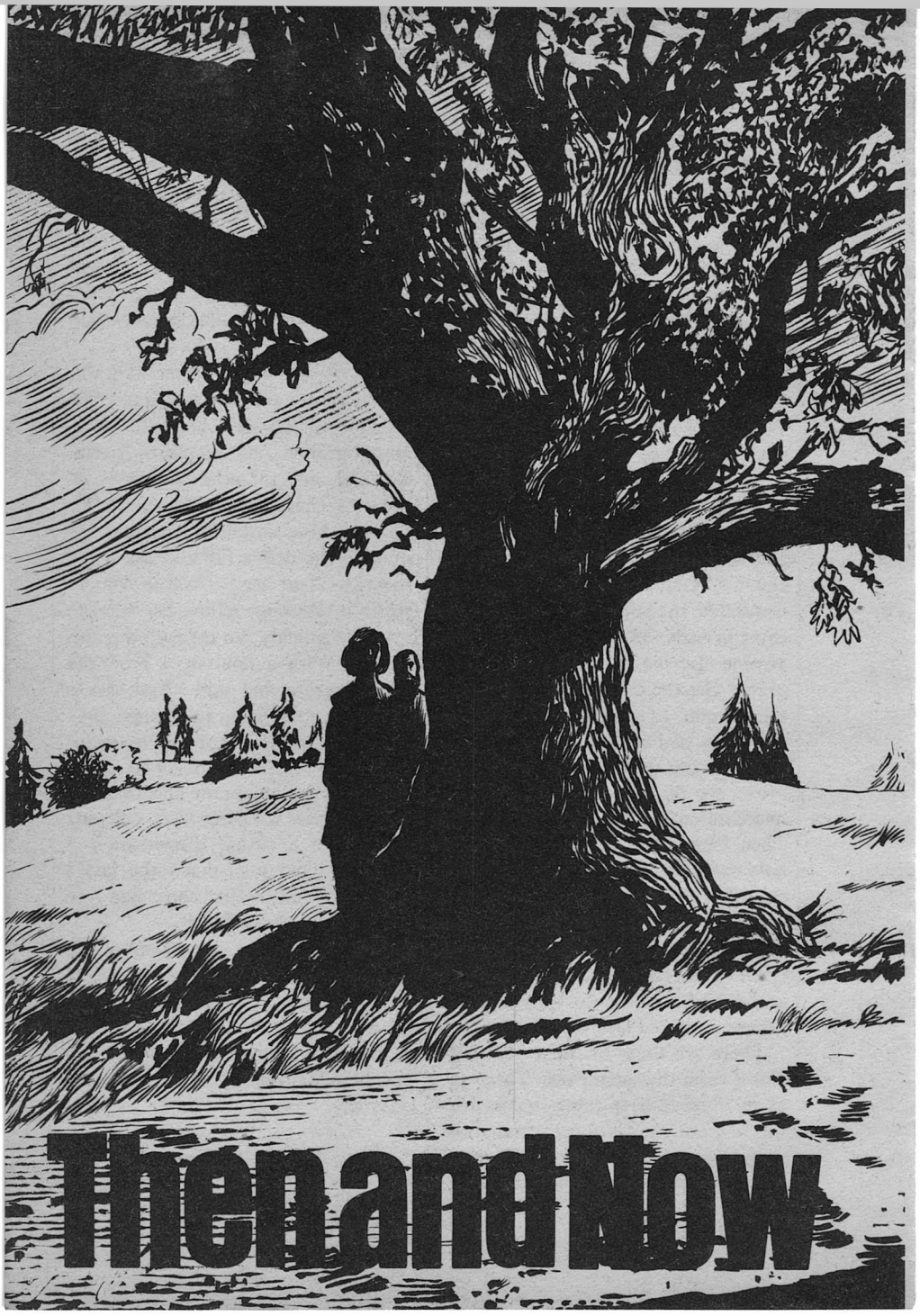
how desperate I was to even consider that alternative! In a moment of unusual lucidity (for me), I saw a simple reaction sequence, starting from cheap materials, that would give me thiotimoline. The only catch was the final step, a photocatalyzed isomerization. It worked for most chemical systems of this type, but sometimes failed when the molecule was very sterically crowded—like this one was. Would it work? Only one way to find out and that was to try it. So I conned an undergrad into thinking I was doing him some great favor and had him running reactions for me night and day. We got as far as the photochemical step and then I took over. I irradiated the sample overnight, and came in early the next morning before anyone else showed up and ran holograms. Set the calendar and clock by the sample, as always. Sure enough, the clock had moved forward, and I was jumping up and down with glee. Now we could get some more numbers out to nail down that grant. Then I looked at the calendar in the hologram. It was the previous day's date. I wasn't photographing the future, I was photographing the past! That stopped me cold. The photocatalyzed isomerization hadn't worked, and I had a molecule with the OH groups extruded into the past.

There are times to shout your successes from the steepletops. There are other times to keep things quiet. This was definitely the latter. I secreted the sample away in the bottom drawer of my desk, wrote a note to the undergraduate saying "Thanks, but the final step didn't work," and told the graduate student to start studying for his preliminary exams and "We'd wait with further experimentation until the grant came in." The case was closed, with nobody the wiser, and I could take time to think out my plan of attack.

Still no trouble. But something this big, you just can't contain all to yourself. So when I went home that evening, I grabbed the sample, my portable laser, and the other gadgetry. At home, I chased my wife out to the kitchen. After carefully setting up my gear on the coffee table in the living room, I called her back in to demonstrate it. Without telling her what to expect, I quickly ran through the procedure. With a flourish, I produced the hologram and said "And this is what you were doing two hours ago." Her cry of no coincided with my realization that she was not alone in the image in the hologram and that she and the man with her were enjoying more than a casual conversation. I swear to God that that's the last I remember until the cops had me locked up in that jail cell.

There's the story. Get me out of this place, and I'll tell you how to make the compound. It should be most useful for your operation. It should keep marriages a lot more honest too. Don't think too long on this. I've only got ten days left.

Sincerely Yours,
P. A. Stence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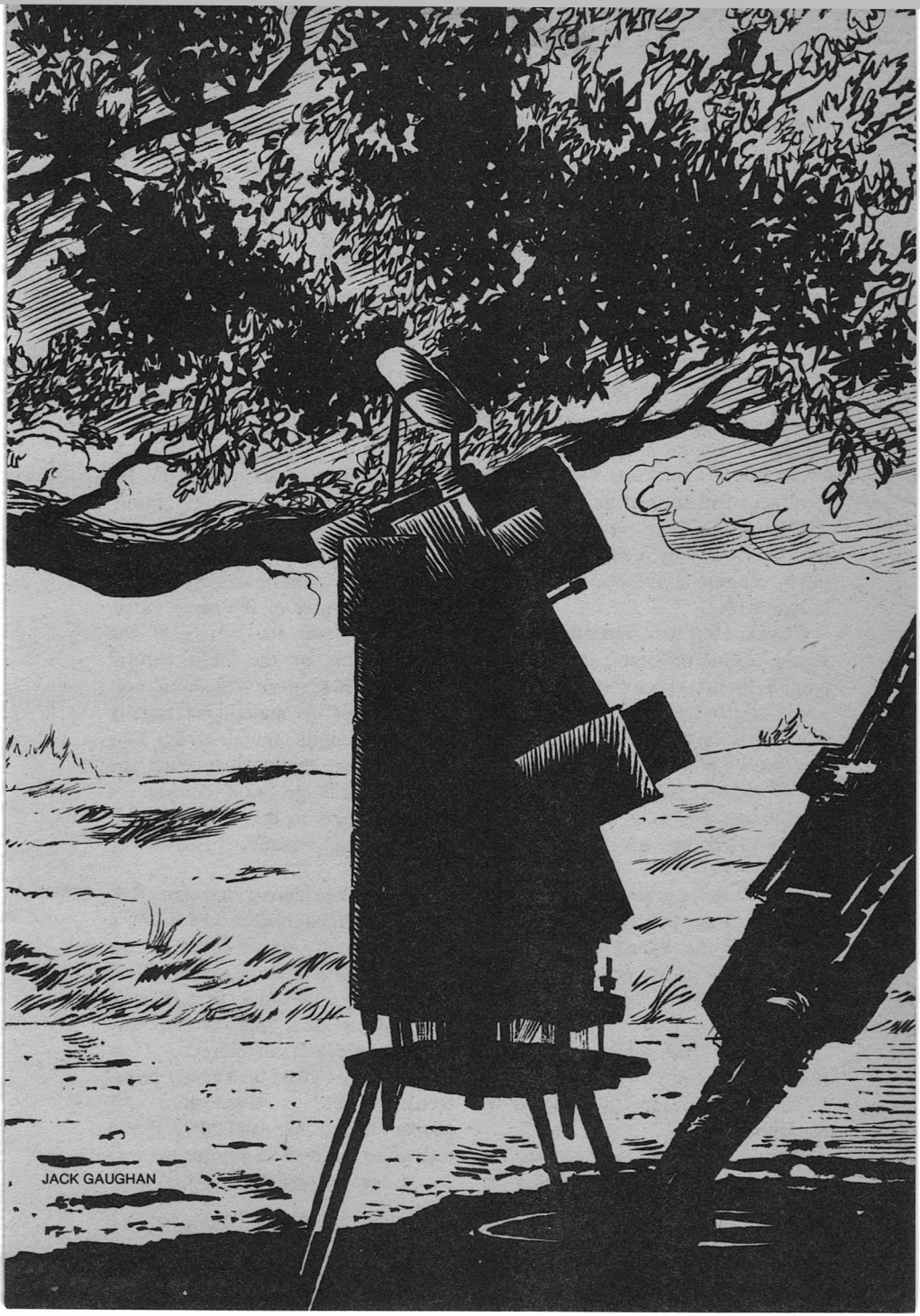

JACK GAUGHAN

All the comforts of home make it hard to go out and be a pioneer.

Raymond Z. Gallun

An hour ago, while the liner they were coming in on was still in space, they had called him again by Visual. Their two faces had formed on the screen. The boy's face hard, reticent, guarding his own judgments. The girl's, dark, eager, humorous, warmly brown-eyed.

Chester Horton had to laugh. There would be fun, affection, and a poetic quality in the encounter. But grimness, scare, sorrow, and splendor, too. And more. Just how was he supposed to think who these people were? That was an element still bizarre enough to Horton, not only to tie his tongue, but almost to disalign his vision. Damn! Damn! . . .

"I can't quite grab everything," he had told those two with high good-spirits over the Visual. "Not sure I want to right away, anyhow. Rather taste it a while. Not using wrong words."

"We can't grab it either," she had responded in kind. "At least not me . . . Better, then, to play it out slow. A pledge?"

"Sure—a pledge," Horton had replied. "Among us three. You—Lois, if I recall? . . . And you—Arnold?

Now Horton was flying in his heli—through warm, sunlit atmosphere—from his villa on the slopes of the Lunar Apennines, to pick up his guests at the Archimedes Spaceport, within the crater of the same name, and diked from the waters of the Imbrium Sea by the lofty, natural ringwall. These were simple, acceptable facts of his action, not usually worth a thought, anymore. But now that he did think back over the decades of change—as circumstances prompted him to do—it was rather wild-seeming, already. Topsy-turvey and . . .

He kept considering that pair. Relatives, emerged once more from a discard-bin of almost-forgetfulness that contained many people. He'd been sort of annoyed at first. Nice to find out, though, that he had any family to speak of, anymore . . . How old had they looked on Visual? Nineteen or twenty? . . . Good kids . . . A couple. Mated. Mr. and Mrs., if you wanted to say it in an antique manner . . . Characteristically vital and com-

petent-appearing . . . But there was that quizzical warping that his guts didn't want to accept—though not now awfully uncommon.

Well, he should skip it a little—suffering and enjoying the effect. He'd promised . . .

However, there was that further thing. Magnificent, yet almost gruesome. For the past two years, by their own statements, they had been training intensively on Titan, Saturn's big satellite. But they had been there much longer. He might as well agree to himself that they had grown up in that superchilled place. Now they were on furlough, for visiting the Moon and Earth. To experience changes and luxuries known to them only through reports and picturings. Their permitted vacation was one terrestrial month.

At its end they would be cryogenically frozen. Among thousands of others, gathered from many regions on Earth and elsewhere, they'd be loaded aboard a new kind of ship. They'd be dead for more than a century of subjective transit-time. The revival-rate should be about eighty-five percent. On an Earthlike world, though cooler. Never reached yet except by probes, transmitting back sketchy data at the slow speed of light. That limiting velocity might never be surpassed, circumvented, or even quite approached, in spite of old dreams, and some hopeful chinks in the physics of the universe.

If those two awakened, that raw, primitive planet—orbiting the red dwarf Barnard's Star—could still kill them. Interstellar colonization was unlikely ever to be swift or easy. But sometimes it was imperative.

Horton told himself silently:

"Got to give these kids the best month I can . . . Not sure I know how . . . Hope they like the old Moon the way it has become . . . Though what do I do if they like it too much? . . . Lunar law. Restrictive. Protective. Necessary . . . Maybe shameful, in some cases? . . ."

He looked down on his world that, among many other persons, he had taken minor, though dangerous and dedicated part in improving. Mare Imbrium—Sea of Rains—at last better deserved its ancient name. On his northward course, Horton was now passing over a large island. Beyond its beaches were the white flecks of villages. Even in its interior, its crags and crater-walls were shagged to their crests with the dark green of young pines, grown taller and slimmer than they could have done on Earth. Around the island, the sun glistened on breeze-riffled water, that spread over a once totally dry plain of windless dust.

The soft clatter of his craft's rotors was echoed up from below. From beneath his knitted, slightly graying brows, he glanced upward into the clear, deep atmosphere. Blue, thin, mostly oxygen, with a few cloud-wisps floating high in it. It had to be lofty-piled to maintain even the low, 350-millibar barometric reading—open-air-pressure being directly related to

weight, and everything, including gases, bearing-down only one-sixth as hard on the Moon as on Earth. No human-devised machine had yet been able effectively to augment a natural sphere's intrinsic gravity.

But the Sun no longer stood almost still in the sky. Its apparent-movement rate had been quickened. Today it had already crept westward, well into midafternoon.

Casually, Horton recalled how these improvements had come about:

First, there had been the conversion of the kinetic energy of two fair-sized asteroids orbiting the Sun, into increased rotation of the lunar mass. Those minor planets had been nudged from their paths, guided close, precisely aimed, then crashed. They were the same sort of bodies that had produced the lunar maria and the largest impact craters billions of years ago. But with the random part of their descent-angles removed. Not steeply down, but in shallow tangents, and exactly along the lunar equator. One colossal chunk of rock and nickel-iron slamming into a highland region adjacent to Mare Tranquillitatis; some weeks later, a similar lump into the antipodal position. Glancing blows, rolls, gougings. Most of that huge energy of motion had been lost as heat, in a blaze of vaporized solids. But enough had been left over . . . Like two hands, striking at a wheel-rim to make it spin faster.

So what had been a Moon-turning of twenty-eight mundane days had been speeded up to twenty-eight hours—much more amenable to a less-wide gain-and-loss of solar warmth during light and darkness, and to the other rhythms of living things.

A wonderful transformation? Perhaps. Yet not as subtle as other, parallel developments in know-how. Mere macromechanics.

The further, major requirements of lunar change had been accomplished by means both grand-scale and simple. On the smaller satellites of Jupiter, far from the Sun, water-ice was as stable as rock. Congealed carbon-dioxide gas and nitrogen were almost as permanent and plentiful. Against low gravity, catapulting these substances into space in great quantities hadn't been too difficult. In fact, several tiny Jovian moons, undiscovered years ago, and composed almost entirely of these materials, could be moved whole . . . Masses, with fanned-out evaporations in their wakes, had moved sunward like comets in tandem—to mush down, vaporize, and spread around Luna's curves. First winds had blown, first rains fallen. What difference that all that had been brought would normally leak away from the weak lunar grip in a couple of millennia, when periodic replenishment could be made from a still-plentiful supply? An artificial magnetic field had also been set up, to trap solar radiation and shield the Moon's surface.

So, vital conditions had been made right. Let scattered green algae spores sprout and begin a process. Plant

chlorophyll working its photosynthetic chemistry. Carbon-dioxide molecules broken. Oxygen and nitrogen freed, to build a breathable atmosphere. Other life imported. Years for the basics to become complete. Further progression to the present.

As an environmental engineer, Horton had been variously involved in the redoing of this world from the start. Meanwhile, he had often been elsewhere. The Jovian system, of course. Mars. Circling Venus in an orbital laboratory. A tougher problem, but maybe that planet's poisonous, hot, and over-pressurized air would one day be mellowed by some effective strain of algae, or other means . . . He had spent time on sun-blasted Mercury. His had been a life of much movement. Yet he had always returned in time to retain his acquired lunar citizenship. Lately, he had remained settled, comfortable, and all but retired.

Now his craft lofted over the high lip of the Archimedes crater. The spaceport was close ahead. The landed liner stood tall and white. Horton's past blurred, as most of Then became Now, challenging his visual, somewhat flinty, aplomb. Yet it pleased him that he could still become this concerned and interested.

Port Traffic brought his heli to a parked landing by remote control. Three minutes later, he stood under the Arrivals Dome, waiting. A considerable wait, while other passengers, mostly from the liner's previous stop on Mars, streamed up the moving belt-ramp. Silly, misplaced vanity, he thought—wondering if he looked acceptable enough, when his guests had already seen him several times on Visual. He seldom felt any apology for his aspect: Swarthy from sun and many origins; trim and spare, with a wide, homely face, rather proudly weathered by time and active doings. There were no aches or stiffness in his joints, nor any dimming of his senses. Modern medicine's minor attentions assured that . . . While the sports-tunic he had changed to for the present errand was in good taste—not as gaudy as most. Jewelry he had left at home . . .

He saw them then, riding up the ramp. No recognition-problem anymore. Horton waved his hand; they waved back across the closing distance. Was his part in the scrutiny-trading the more avid? Seeking signs of remote but remembered likeness. Family resemblance? Hah! . . . But yes, there was some . . . No doubt prejudiced, Horton felt forcefully that these two looked very pleasing. Paternal pride? Hah, again . . .

More sharply, he found contrast. Between them and himself. His affluence, maturity. Their unowning simplicity—near poverty. As of young goals not yet won. Yet again—hah! Have and have-not. Fair? Especially for them? . . . Still, the worth of the intangible, versus the material . . . He, himself, remaining part idealist? Shamed? . . . All of this darkly accented and warped by a strange incompatibility of facts, which, now,

both by his will, and by convincing visible evidence, faded to a background whisper in his head.

So, just then, Horton beheld them much as they were: Both in medium-close-fitting coveralls, blue, clean, and a bit frayed. The young man tall, wiry, a little swaggery, one large thumb thrust under his wide belt. The girl almost tiny, and poised like some restrained and eager pupdog. At their feet, riding the belt-ramp too, were their new rucksacks—compact, practical baggage.

Now from closer, Horton saw the mottled scar on the young man's left cheek, above his scant, sandy beard. On Visual, he had noticed it before. An obvious relic of a cold-burn—from some momentary flesh-contact with the natural ambience of Titan. So another difference was emphasized: That world where they had toiled, and this gentle, easy one that was his home. An embarrassment?

They stood before him, now.

"Hi!" Horton said. This archaic greeting came out of him easily enough.

Then the girl's arms were tight around his neck, for a quick, uninhibited buss. Jupiter!—like a child's hug and kiss!—Horton thought with some wonder.

"Chet!"

"Uh-hug—Lois."

In the general, first-name social-practice, Horton had just felt a hesitation. However the use of another mode of address seemed blocked by much more than promise.

Then his fingers were gripped by a more calloused hand.

"Hello—Chester Horton—Sir!"

Respect commonly due . . . ? Or a faking of it? For fun. Had to be. How else? . . . Insolence? A patronization? With a taint of masked savagery? . . . A deep one, this guy! . . . For an instant, Horton was almost angered. Until his own mind recaptured more of a willfully dropped thread. This pair was having its uncertainties, and confusions too. For sure. Groping at the strange. And not knowing him. How else to cope, except in fun? . . . So, on which side should the respect lie? . . . On both . . . Here, humble tenderness reached him.

"Maybe you can guess how good it is to have the pair of you with me, Arnold . . ."

Horton paused, then spoke on:

"You didn't come up the ramp right away. So Visitor Hospitality gave you a close check."

Supple shoulders bobbed. "No more than expected," said the boy. "We aren't smugglers. And we had our thirty terrestrial-days' permits, for seeing the Moon and the Earth."

Horton noted the small clusters of plastic flowers that a VH inspector had pinned to their coverall-lapels. Disguised as bright emblems of greeting, but always to be worn, or kept near, while within lunar or terrestrial jurisdiction. For embedded in each was a tracer-transmitter, by which the locations of transients could always be known—unless they broke laws.

Chester Horton wanted to apologize, explain: That the Moon, though lately become an independent nation, retained Earthly statutes and an alliance. That it already had two-hundred million inhabitants, enough for so small a sphere. That even with offspring limited to two per mated couple, this population was bound to increase . . . That this world was a desired place, into which innumerable other millions yearned to immigrate—illegally, since at last there was no other way . . . But didn't so attractive a region have a perfect right to defend itself from becoming an overcrowded slum? Hence the steel firm though velvet-sheathed rule: No person not a citizen, or an authorized representative of another government, would be allowed to remain, beyond the standard visiting interval . . . Earth, truly crammed with humanity, not only had similar statutes, but constantly urged its people outward.

Horton believed in all this. How else could anything be preserved? While yielding none of his conviction, still he squirmed somewhat, under it now . . . Though why—prematurely? His guests were conforming to a larger plan and destination. They were only visiting the Moon; they hadn't asked to stay. It was silly for him to speculate—imagining conflicts of legal rightness with personal sentiments, deserved exceptions, and then with the shame of favoring. And as for explaining lunar law to these kids, they were surely as aware as he, and seemed acquiescent.

Perhaps it was the massiveness of too much to be said, that now blocked speech among all three present.

Horton had already pressed a control on the little, round case in his tunic breast-pocket. In response, his heli returned to him, drawn quietly close, along an outgoing traffic-rail.

He moved to load the slight baggage. But other action was quicker, smoother, and well-practiced, from Titan, in low-gravity.

"Hey!" he protested mildly.

This was met by as mild a laughter from the two. An easing.

"Get in, children," Horton urged. Just then, that last word seemed quite natural to him. "Now, be observers, eh?"

The craft lofted upward, through the circular exit-port in the domed roof. It climbed much higher, to pass over the crater-wall. Then it dropped to a level, 800-meter altitude.

The talk-suppression persisted. Horton had much to savor proudly, mystically, yet to find splinters of anguish in, for his crusted soul: The reactions of his guests—not long released from Titan's super-chill—to a different grandeur, the idyllic views, and the kinder reality of many changes all around, as the heli swayed and bobbed in vagrant air-currents. Her dark, swiveling head. Her lips rapturously parted. The boy's controlled intensity, masked, it seemed, by a bluff of casualness.

She spoke at last, softly:

"Chet—I knew it had to be lovely. But what are mere pictures? . . . All

this color . . . Greens, blues . . . And feeling the wind . . . Look! . . . The wake of that speedboat down there!"

Reaching Horton almost more forcefully, was a single, muttered expletive from the boy, more a grunt than a word. Restrained, private, yet exploding outward. "Agghh!" Like a gambler's rage at a bad choice, when he belatedly sees a better one that he cannot make?

Horton glanced at the young man, finding fury in his face. But it faded to wry humor at once.

"It was different when I was first here," Horton remarked in his raspy voice. Should he feel tiresome, saying that?

The girl's mobile features were at once specially intent. Eager pup-dog again? One with sly, private purposes? . . .

"Tell us, Chet!" she urged. "How it was . . . When you were around in all that history . . ."

Live interest seemed to vibrate from her gaze. Horton shook his head, as if to straighten a twist in his eyes. But he guessed her mood. Quite like his own . . . He looked ahead dreamily, toward the Apennines, over which afternoon mists were gathering.

"Sure. A duffer's story," he said.

He was thinking back. To Earth. To what had been . . . A chaotic time. Bad. Good . . . But already richly varied. Disturbing to many . . . Numerous careers possible . . . Pursued, shifted . . . Intense, personal attachments formed; then broken or faded . . . But who found room for much weeping? . . . His transient, medical father . . . Dead at last in a space-accident . . . His distaff parent gone, too—separately . . . From some virulent allergy, while entertaining in a remote survey-station on Mars . . .

His eyes remained fixed ahead, on the southern sky. He chuckled, then began the telling:

"That summer when I was ten, my mother, bound on a pole-to-pole theatrical-appearance tour, on Earth, sent me out here to people I think she only half knew. It wasn't a common thing, but sometimes done. I was crazy-anxious to come, but scared stiff. There were only about ten thousand persons living here, then—every kind of specialist—selenologists, resources-assayers, constructors—all quartered in underground, pressurized warrens. I stayed with a fiftyish couple, and at first was very homesick. He was a cat-driver, tunnel-excavator-operator, and had lots of other skills. He'd growl at me, boxing my ears for any careless act in a dangerous environment where survival was possible only by attentively-handled, artificial means. But sometimes he'd grab my shoulder, and talk to me man-to-man. About how the Moon might be made into a great place.

"She was easier on me, but tough too, and just as busy. With hydroponics, and other biological stuff. But do you know, in our little apartment, like all the others—neat and compact, with fold-away tables and bunks, even a recessed electric stove, so we didn't

always have to eat in the mess hall. She'd usually have a flower or two in a vase, from a small, special tank she kept in the hydroponics area. Petunias, violets, irises. Once even a rose! . . . And sometimes, on special occasions, out of scant free time, she'd scrounge up scarce or make-do ingredients, and contrive a cake, or other unusual treat . . .

"Well—I got to enjoy being on the Moon. I felt competent and confident in all the fascinating strangeness. I liked doing chores around the garden chambers. There was a one-master, one-mistress school for us few children. Folks were rugged and friendly. Rules and discipline were firm, but cooperation and interdependence were like a solid thing to grab hold . . . Armored, I got outdoors quite often. I'd look at the black sky, and those mountains, the Apennines—same contours as now, but bare-gray to their tops, and vacuum-clear under the raw sunglare. And I'd think of all that absolute, dusty desolation as some monster to kill. Yet I'd admit, too, that it had a hard, thrilling beauty, all natural . . . I'd almost hope that the change we all wanted and talked about would never happen . . . Hey—one place I'm going to have to show you people is the burrow where I lived, then. Right near my present home."

Horton drew breath, smirked in a private way, and went on:

"But that year ended. I had to return to Earth, to advance my education. Boarding school, then university. Always hurrying. Letters, I hardly had time to answer. When I finally got back here, everybody I had known best had moved on. Sure—loss. But who sweats such things when he's twenty, and has his own purposes, and new, personal attachments? . . . On to Mars briefly, that time . . ."

Enough. Horton stopped talking. But for seconds more, the girl's expression remained gently, humorously pleased, bemused still, as from secret listening.

"Thanks for that much, Chet," she said.

The boy, Arnold, gave a faint, dry snort. Derision, yet tolerance, for bubble-headed nonsense? Or something more? . . .

"We'll be getting close," he asserted, all apparent diffidence gone. "Is that white speck on the slope your house, Chester? Look—I'd like to bring us in, from here—manually. To see how it works in this atmosphere."

"Of course. So take us, Arnie go in . . ."

They flew on. Until, under light-fingered manipulation, the heli slanted in, to a light rest, on Horton's landing-stage.

A housekeeping device rolled forward on elastic wheels, and gathered the rucksacks. Quickly, then, Arnold extended his lean length in a deck-chair on the flagged terrace by the swimming pool.

The dense foliage on the surrounding mountain slope rustled in the breeze. A North American robin's scolding from a thicket was atten-

uated slightly from what it would have been in the denser air of the bird's native habitat. But who, here, could recall, or notice?

Arnold sighed, closing his eyes.

"Go away, everybody," he grumbled. "I'm not wasting precious time, Loey—I'm using it best . . . Soaking the cold out of my guts . . . If I ever can . . . Having second thoughts. I've felt chill enough. Who needs the deep-freeze?"

Alerted, Horton looked down at him, seeing first how one large hand clutched the flower-cluster on his garment, muffling its monitor-sensors. How much of what had just been spoken was mere, playful grousing, and how much was serious? Was this the first plain indication of the problem he had nearly anticipated? Horton felt a slight chill, for here he remained divided: Love and law opposed in him. How would he handle the dilemma—if actually so confronted? He felt prompted to ask plain questions. To get a clearer idea of what was going to happen, at least.

But she—Lois—touched his arm, then her puckered lips with a vertical forefinger, in the common, elfin sign for silence, that reached some lost part of himself, pleasantly.

"Let Arnie be, Chet," she said, her voice low. "He'll be all right—I think. So come—show me your house."

Horton didn't really show her; he only followed, as her feminine urges led her on. Her rough boots contacted his rich rugs. It was like some eternal vagabond-urchin's tiptoed intrusion into elegance, though there was no timidity in her. Smirking slyly, Horton relished to watch, knowing, inside his silent head, what much of all this might mean—a convoluted thing, part humor, part pain to him. Her eyes wandered; she hungered perhaps to be mistress of such a habitation, which she had never had, herself, and, except for the few days here, probably never would . . . Though Horton thought much deeper than this . . .

In the library, late sunlight gleamed back from the shelves of old books. His collection. Classics, and other past-dated literature—even imaginings of what was supposed to be the present. Briefly, her groping, meditative gaze scanned titles, but her small chucklings went unexplained. Nowadays, most books existed only as miniscule audiovisual recordings.

Once she said, almost reverently, "A lovely house, Chet. You've done well in things. I'm glad . . ." Her tone mused; her brown eyes still wandered, in wonder. Yet her slight shoulders moved. A shrug of wistfulness? Or of rejection for what was better? . . .

Then she paused before a tiny console.

"May I, Chet? Music we did have, on Titan."

"Why even ask?"

She touched a control-sensor marked *Mood*. Quiet notes stirred and rippled, as she rambled on, exploring other rooms and their fine fittings. In a tiny courtyard, she bent to smell a

rose, while humming to herself. Suddenly she inquired:

"Dear Chester—just how is it, to be old?"

"Ho!" he chuckled, startled. "But—well—*old* hasn't been bad—to me. A contemplative interlude. Some good friends—all ages. Enough work—not much, and no strain—still an environmental engineering consultant. Yet,"—here Horton became remarkably confessive—"a few wrenching thoughts that didn't bother me much when I had strong purposes. People I lost, or who lost me. Relatives, loves. Dead. Or scattered . . . Shall I name names? . . . And when I learned that you and he were coming from Titan . . . From lots farther—in a way—even . . ."

"Shhh! We vowed, Chet . . ." Her smile twinkled, then saddened. A rich, incomprehensible essence of shared, hidden knowing seemed to flow between Horton and this girl, while benign ghosts, not quite matching, stood by, taking part. "As for names," she continued, "let them be—when they're gone . . ."

From somewhere, an antique clock ticked slowly, inexorably counting time. It had inset magnets to compensate for the weak, lunar pull on its pendulum, thus to increase the swing-rate to Earth-norm. But its hand-movement ignored the four extra hours of the lunar day.

"Anyhow, I'm glad I'm young," she stated.

"Even though—?"

"I'll say it, if you're scared to, Chet. Personal Ice Age awfully near—for Arnie and me. Complete shutdown—our long blinking-out. Fifteen chances in a hundred of not coming through at all. Even then, otherwise, into just what? Frightened I am. So is he . . . But going it like the way we are. Besides; it has got to be . . . Though now—we'd like to stay here longer—I think . . . Such a fine world! We didn't realize . . . But the laws are right—I suppose . . ."

Horton wanted to insist that it was their world, more than for most—surely! But she stepped lightly on, through his male-oriented habitation, still humming a nameless tune, and diverted to other fittings and objects. Fireplace . . . Chinese ceramics . . . Then, gleaming, automated kitchen . . . Horton considered:

All the mismatched pieces I know—and now see—that this person is. The confusion, part of the charm . . . Courage . . . Philosophy . . . And alive to everything . . . Young-old. Admirable . . . Does youth always have an ancient wisdom? . . . This oblique thing . . . And what amounts to death . . . Though more . . . Their true wishes? What should they get? . . .

Still following the girl, Horton re-emerged on the terrace.

Arnold, hair seal-slick with wet, thrust his head up from the pool, spat a spray of water playfully toward them, roared out in wordless pleasure; ducked again, gurgling. Horton knew that, on Titan, these two would have had only a communal tank, warmed

and buried far under the super-cold, for such recreation. He could appreciate the boy's pleasure at the difference, here.

With soft thumps of dropped boots and a swish of cloth—it seemed all completed in a burst of impulsive motion—Lois joined her mate, the splash of her dive slow and huge. Fleetingly, Horton remembered that, in Earth-gravity, even wavelets were tighter, smaller, quicker in their rhythm.

Lithe and bare, she came out to dive again, glistening and beautiful. Horton looked once, hard, then turned away. His maleness hadn't died; often there were other attractive visitors in this house. Nude swimming was part of the natural mode to all. But now a prudery, from farther back than his own distant birthdate, twisted him. His cheeks almost burned. Taboo?

She plunged once more, but the youth's head was thrust up again from the water. His faun-grin was wide, aggressive, comic, knowing—maybe even threatening? No cautious reserve remained. Between generations, there was often an uncertainty of comprehension. How, then to judge the growled, laughing words? A jest, or serious?—

"Watch your eyes, Old Lad! I saw that! She's my woman!"

The sandy hair dipped briefly from view; the mocking face reappeared. More words were spoken:

"Chester—Sir! You and Loey, included me in the game! . . . Got answers for yourself, haven't you—Big Man? Here, in what they call the Garden World of the Solar System! Being human, don't Loey and I merit Paradise, too? Want us for permanent boarders? Eh?"

Horton tensed a bit, almost, at first, from insult. But no—it had to be only a tease. But the other portion? Clearly stated, now? A difficult prospect to deal with—guilty both ways . . . Still not plain, either—more joking easily possible. Horton relaxed. It felt better when any difficulty was in the open—or nearly—there to be talked out. Horton lost no poise. In a moment he tough-teased back in quiet warning:

"Careful, Fella. I like being legal."

He glanced toward where the shed garments—together with the monitor devices—were quite neatly stacked; even Lois, in her haste, had managed that, with hers. A sufficient distance. Anyhow, who would be listening or recording? Effective surveillance was not *that* paranoid!

Horton walked a step, bent close to the boy in the water, and spoke softly:

"If you want to, though, let's discuss what you said, sometime soon. You and Lois mean considerable to me."

The young face had sobered; when the voice came again, it sounded almost stern:

"I'd hoped we do mean something, Chester. Thanks. So maybe soon. Just now is for play."

Arnold submerged. His long form became a wavery-limbed caricature, deep down. He surfaced. The levity

was back. The girl dived for a third time, and shoved his head under water, muffling his hoarse shout.

Horton didn't swim then. Instead he fixed himself a drink—in the archaic manner, ignoring the services of the motile-bar. Then he lounged, sipped, and meditated, watching the aquatic pleasures of his guests. Sometimes he muttered cheerful, bewildered, and marveling curses into his close-trimmed whiskers. His emotions kept stumbling in a strange, disarranged territory, where he remained rather happily lost. He liked the whole thing. No, he loved it—and them. Except for the stilled ending . . .

After a while, Arnold, clothed again, getting drinks for his mate and himself, came near.

"Freshen yours up, Chester?" His tone was quietly solicitous now.

"Thank you. Please . . ."

All three lazed in the long chairs, watching the sunset, slightly on their left. Lofty, red, cloud-flecked, shimmering on the sea, which curved close to the slope below, but extended far away. The rosy glow tinted the white structures of villages, along the arc of shore, toward the southwest and the great, green bowl of the crater, Eratosthenes. Roads were pale threads. While to the east, visible by a right-turning of the head, Earth had broached the mountain-tops: A blue-and-white-swirled agate-marble, very large, its shine still muted by the lingering daylight. Whippoorwills began their cadenced calls. Bats circled and swooped, the flight they had learned here, slower than that of their terrestrial ancestors.

Once the girl murmured, "There aren't any words . . . I shut my eyes just to listen . . . So I can look again . . . Lovely . . ."

In this mood of awed monosyllables and quiet, surely nothing was said of the jagged subject almost reached before. But when kitchen fragrances intruded into the dew-damp scent of flowers, Horton spoke up:

"Thirty minutes till dinner. Time enough to save showing you where I first lived. I'm local historical custodian. Want to look?"

Lois was quickly on her feet. Arnold, with the languor of a conforming spouse, sighed, and arose . . .

Horton touched a switch, lighting lamps along a rocky path leading two-hundred meters down the mountainside, to an antique airlock.

Arriving before the sealed, magnesium-alloy portal, Horton adopted, for comedy, the manner of a professional guide, as he worked a small lever:

"Back into the rough past . . ."

Beyond the lock, other lamps were made to burn. White-walled corridors extended and fanned out, deep into the lunar Apennines.

Horton continued to clown, solemnly: "It still smells a little like it used to. Of zero-watered Moon dust. Powdery and burnt . . ."

"Truly, Sir? Truly?" the girl asked. "Oh—I want to know and feel just how it was—everything you remember! . . ."

In her low tone, much seemed min-

gled: awe, as in some shrine. Yet fun. And a probing of him—Chet Horton. Affectionate and enigmatic. A love, too, of all that she discovered around her. As if she tried to grasp the real-living of ancestors? . . .

"Mizz," Horton laughed gruffly, "what you ask would take longer than we can manage. Come along, please . . ."

They visited only a fraction of what was here: central chamber of the life-support system, repair shops, laboratory, recreation hall. Mess hall . . . Everything empty of motion and people. Then the extensive region of tiered, hydroponic tanks, now dry. Only a few of the solar-lamps could still burn. Horton continued his spiel:

". . . I worked in this place myself, when I was a small guy . . . Just beyond—I'll show you—is where we raised rabbits and chickens for ourselves, feeding them clover we grew, and dried algae-meal . . . A bit farther on are the living quarters. The folks I stayed with had number seven. In a minute . . ."

Horton unlocked the white door. The apartment was still neat, except for crumbled flower petals littering a tabletop, around dead stems in a dry vase.

This girl—Lois—rummaged with her gaze, and touched lightly with her fingers—the fallen petals, first—as if to bring the lost parent-era of Now—with its domestic sounds, smells and movements—into her young self. From long before this actual flesh of hers had been. Cupboards, foldaway

bunks, stove, fridge . . . Horton watched guardedly, in amusement, relish, yet with some pain, and much wondering. She opened a closet. Three obsolete spacesuits of stepped sizes were still racked there.

"You were happy here Chet?"

Horton stopped playing guide:

"Guess so. Till then, the most I'd been."

Her wide mouth curved upward more. But Horton noticed wryly that her cheeks had dewed. She chuckled in apology.

"Haw!" Arnold scoffed in rough humor that surely had occult undertones. "Don't go blubbering over dead junk, Loey! Didn't we have enough borrow-dwelling on Titan? Let's get back to pleasant stuff . . ."

Quickly they climbed back to Horton's villa. To a fine dinner, served on the terrace by housekeeping mechanisms: Steak from the diked Procellarum-plains. Red wine from the slopes of Copernicus. These novelties for Lois to exclaim over, and absorb with as much gusto as did Arnold. Then, quietly, came her talk with Horton about mutual concerns:

". . . Lots I never knew, Chet . . . Hard to make and keep contact—the way our clan got spread around. Far apart, with new friends. I'm a failure at holding on . . . But now and then I feel rotten, and I try. So does Arnie. Though I usually think—let the unknowns be . . . But on the way to here, while the liner stopped at Solis Lacus City, on Mars, we looked up George, your younger son. He was attentive, though acting some as if in duty to a riddle. Though there were two little girls—his own son's. Adorable. Very friendly. Wondering who we strangers were. But not seeming much interested when we tried to explain . . . Still—George mentioned you, Chet. Another obscured shape we'd heard recent reports about, and rather noted . . . Well—we decided to get in touch. So here we all are, and I'm very glad . . . Care to fill us in on anything further?"

Horton smiled thinly, though gently, into the night of lamps and Earthshine. "There's not much that you don't already know, or won't see. So you met George. He and I exchange greeting messages maybe four times a year. With Ben, my elder boy—on Ganymede—it's less often. Once in a while with his mother—there, too, now, I think . . . Thanks for saying something about the tots. I keep thinking I'll go, and try to get acquainted. But I don't feel much like traveling so far anymore . . . Hey!"—here Horton chuckled. "Family stuff can depress."

She grinned back, setting that vertical forefinger across her lips.

Arnold, the background presence, spoke up:

"Yes—subject change. Where are you taking us tomorrow, Chester?"

"Wherever you choose. Or I'll lend you the heli or a car, if you prefer to go alone."

"Then we'll see—in the morning."

They all moved, so that the table could be cleared, and sat quietly for a

bit. In the brilliant Earthglow, the true stars were dim. But brighter sparks, visible past the reed-thatch that roofed this portion of the terrace, were not stars. A solar-power-station, in an orbit synchronous with lunar rotation, hung perpetually in the south, microwaving energy down, to augment nuclear-fusion sources. Northward, in a gathering blob of thickened darkness, lightning flickered, portending the controlled, nocturnal rain. But in the western clarity of sky, another bright speck gleamed. Lois pointed to it.

"Uh-huh—one of the artificial planets, just now passing the Moon—and in powered motion to avoid capture—but actually in solar orbit," Horton said. "A cylinder like the others, rotating to simulate gravity on its inner curve."

"I wish we had time and permission to visit one," Lois mused. "Planted fields there. Woods, towns. A lake. Twenty-thousand inhabitants to each cylinder."

"And the first were built from lunar substance," Horton amended. "Until the people already living here stopped that abomination. We had better plans for our world. Let the materials come from the relatively useless asteroids."

In a moment, Arnold drawled unaggressively, yet with mordant belief: "Sure—a temporary solution. Till the asteroids are all gone. Then? . . . Someday all the substance of the natural worlds of this solar system is going to be broken up to make such cylinders, till they are a swarm orbiting the Sun, as do the lumps of the Rings, going around Saturn. This beautiful garden-sphere will be grist, too, when the need for more room becomes sufficiently compelling. And none of all this will be anywhere near enough to contain the expanding human population."

Horton had no wish to contradict these fateful pronouncements. There was the accepted prognosis for the future of mankind, if it was to survive at all. Joined with adventurous curiosity, this prediction was already the mainspring of the push outward into the universe. Beyond surface-intellectualizations, that drive was as primal, unthinking, right, and beyond willful control as any other natural phenomenon. Like a super-nova explosion. You were carried along. For any regrets, the one saving knowledge was that the time spoken of was yet a good ways off.

Below the terrace, down near the beaches of the Imbrium Sea, the lights of distant traffic hurried. Overhead, a patrol-heli throbbed past, on electronic watch for any disorder or irregularity. Horton had noted that the two were wearing their monitor-flower-clusters dutifully. Now he sensed how they drifted into privacy. He felt a chill of loneliness so unusual that it made him smile. More forcefully, once more, he had that warped, poetic double-view of them. Apart, he saw how the girl's hand crept into the youth's. Might those hands really have been different? . . .

With a low thunder-rumble, the rain began. A muffled, plopping beat on thatch and foliage. In the glow from the terrace lamps, you could see the drops. Lois skipped from beneath the roof, drawing Arnold with her.

"Big—and slow-falling! Like—like—Earthly snowflakes? . . . Though warm! . . . Arnie! . . ."

The two, tough for certain mature, cool, and knowledgeable in many exacting duties, none-the-less cavorted, screamed, and roared like happy small children released from confinement to a new, marvelous pleasure. They were quickly, joyfully soaked. At last they stood quieted, a shabby pair, each with an arm across the other's waist, facing the night together. Their gaze shifted toward a moment of jewel-shine from the dripping dark. Eyes of a deer, reflecting? There was a scamper and rustle on the wooded slope, as the creature retreated. The boy made some gruff, low-toned comment; the girl chortled in delight.

From his detachment, Horton still watched them with fond good humor, yet with anguish. In his numerous years, he had experienced much of life, death, and necessary risk, and accepted the facts, even gloried in them. But above this hardness, the strain wrenched him more sharply, as he found how deep was his affection for these people, feeling the strange, convoluted truths that enveloped them, and seeing their aliveness in these present moments. How could it match that all this must end so soon—though compelled by need for vaster reaching? Joyful movement to deep frost. When even to him, at his age, a mimimum hundred-and-twenty years seemed very long indeed . . . They had suffered hardships . . . And in mere days they would be deprived further. Arnold should speak clearly . . . If their minds have changed? . . . And just what should he, Chester Horton, do then? . . .

But now another thought came to Horton. Their heads were together in the ponderous, gentle rain; their attention was toward the forest. A stance for plotting? Tempted in an ideal land. What difference if they didn't even have sleeping-bags? Slip away. Live off the wilderness that had been encouraged to grow naturally, undisturbed . . . Hide. An extra month. Three. Six . . . It had been done before . . . No real penalty for capture . . . Still firm ejection. But delayed by whatever time it was possible to steal. That much, at least. These two were surely resourceful . . . Maybe they preferred to act alone, not wishing to involve him . . . Was that why Arnold hadn't said any more? . . .

Horton felt dishonorable, but relieved. Though his affection was undiminished. He wasn't tired at all. But most likely, they didn't even want his presence. So he called out softly:

"A busy day—bed for me. Good night!"

They seemed not to hear.

He was almost convinced that they would go. But after a troubled sleep,

he awoke in the crisp sunrise-time of a thin atmosphere, and smelled coffee, and bacon and eggs. For once he ignored his rigorous hour of workout on an exerciser-machine, and hurried toward the sounds in the automated kitchen. Most agreeably Lois said:

"Joining our early start, Chet? We were down the slope to the beach, for a quick dunking in the sea . . ."

That morning, the heli took them the thousand kilometers to the highland edge of Mare Tranquillitatis, where the first asteroid had crashed at a shallow angle, applying spin-torque to the lunar bulk. Flying at low altitude, they looked down at that hundred-kilometer-long gash—also many kilometers broad—where rock had vaporized, to cool and settle as jewel-like particles of glassy dust. But the wound had scarred over, now, its jaggedness healed by stands of tall conifers.

Horton saw the young man's scrutiny of the topography below, detail by detail, his narrowed gaze moving methodically. Horton was heartened once more, wishing that the kid was planning an escape after all, not at once, perhaps, but in his and his mate's own good time.

Arnold landed the craft at the end of that gouged trench, where the nickel-iron alloy of the asteroid continued to be mined. Near the mine-buildings, Horton and his guests mingled briefly with a crowd of colorfully costumed sightseers, mostly lunar citizens, gathered at a viewing point at the lip of the gash. There were carnival smells and music, and the noise of children.

"Where were you, Chet, when the impact came?" Lois asked.

"Here on the Moon," he answered cockily, from vivid remembrance. "Well-east and north, by the Mare Crisium station. Spacesuited and out in the open, to avoid being caught in some shock-collapsed tunnel. We knew that many installations would be damaged. Few of us Moon-folk complained about this side effect. We'd lived in artificially maintained environments; new equipment and doings didn't scare us. Also we had learned that nothing is gained without risk and price. Earth, from which major assistance was coming, should benefit greatly, too—widened commerce, and especially an outlet for excess population. We had broad agreement from there. But on Earth, technology hadn't yet regained full respect as the principal saving force. There were still many vociferous people who worried that quickening lunar rotation might somehow disturb tidal rhythms, cause terrestrial quakes, even an axis shift, and thus, gross climate disruptions. The fantasies stirred up over so distant, and relatively slight, changes in celestial motion, were truly wild. But sensible opinion won out, on Terra, too. Oh, there were some bad hurricanes there, during increased-spin operations. Coincidence? I won't absolutely insist . . . Hey—why have I told you what everybody knows?"

One thing, Horton hadn't recounted. It wasn't common knowledge: he hadn't been alone there, out-

side the Crisium station. Tana—pregnant with Ben, his eldest son—had been with him. Clad in metal-and-polymer garments, they had embraced, touching helmets. Waiting, they had said silly, laughing, tender things. The colossal, but distant impact had come, hurling them meters away, together. Not once, but several times, to-an-fro in huge, wide-spaced reverberations . . . They had rolled as one, laughing more—thrilled . . . Fearless, comical, lovely Tana . . . Gone from him not much later, by his own restless impatience and hers, in a broad and restless era . . . Like Emiko also, farther along . . .

Back to this present, lunar noontime: Not distant from the spin-scar was another, older gouging. Geometrical, rectangular, downward-stepped —greened-over now. The heli's passengers looked down on a square lake, and on gardens, orchards, and dwellings set on different levels, angular at their edges, conforming to a huge ruin.

Later, and nearer to Horton's home, as the hot sun declined, these three were making foot-tracks on a wet beach that, for three billion years, had been an arid dust of tiny, glassy beads, condensed out of the rock-vaporings of primal meteoroid impacts. But splendid surf surged and retreated here, now, sending pseudopods of bubbly water against bare toes. Tidal areas were considerable; had this sea been of anything like terrestrial size, the tides, pulled by the Earth, would have been enormous. Blue sand crabs scampered, unable ever to know that their kind had first spawned, ungraspably far back, on another sphere. While two kilometers away, a vigorous if leisurely stream poured into the waves from what had been a sinuous lunar rille.

The three swam far out. They burst from depths, gasping, then laughing. Horton's antique clock was nowhere near, to remind, with its majestic tick, that the allotted terrestrial month had begun to dwindle. But Horton, at least, was aware.

So it kept on. Two days less. Three . . . Five . . . These, the longer, lunar days . . . More and more, it seemed natural to Horton to address his guests as Arnold or Arnie, Loey, or just Hey, Kids!—conforming to visible, existing fact. Perhaps with little strain from the start, they continued to call him Chet, Chester, or even Old Man. All play-names, in part . . . It may be that the boy humored his mate and Horton in much of this, but he cooperated, grinning or gruffing elusively . . .

Thus, the arcane background element blurred and softened somewhat. Known, and surely still felt by all three, it kept on being jagged, comic, and quite unacceptable in one way, yet so agreeably fragile that—for this reason, too—they avoided saying it out, lest its spell be shattered.

But if Horton was partly an enjoying romantic, there was that grimmer circumstance to contrast with shared pleasures more and more. It had become another unmentionable. Out of

place. A flaw. Always nearer . . . Brittle breakoff. More chilled than loneliness . . .

He had believed at first that these kids would run, effecting temporary self-rescue. Then he almost hoped that they would approach him, asking for the difficult, if not the impossible. Against his basic convictions, too . . . Neither had yet happened. He hesitated to inquire if they had firmly decided to let their course stand as fixed. He couldn't argue with the general rightness and honorable need-serving of that. Yet, in fleeting moments, one or the other of the pair might seem pensive, a bit depressed. And they were most of what was left of his own . . . Divided and—unlike his usual way—uncertain, he had still not spoken out, himself, offering whatever help. Besides, he felt oddly in awe of them. So he drifted on . . .

Passing-time was well-filled. Based at Horton's villa, the three did much as any resident-host and his guests do, in whatever interesting region. Going to restaurants, theaters, ideally-designed hamlets, factories hidden underground and pollutionless, museums, sports events, other scenic or historical locations. Driving there, or flying . . .

Also to stores. At Horton's insistent urging—his well-funded credit-credential in hand—the two, particularly Lois, acquired costly and decorative garments that they might never wear as much as once. But for this girl, to shop for such items was a joy of which she had had very little. Let her indulge fully . . . Even so, she was sparing and hesitant . . .

Of course one day they all went up into the Descartes highlands, to the spot where the relics of one of the earliest human visitations to the Moon were preserved. Apollo 16. The site was sheltered by a clear, plastic dome, sealed, and with the original, spatial vacuum inside, for this cover had been firmly set up and ground-anchored, well before any atmosphere had been brought. There was no entrance for any bodily intrusion. Within, nothing had changed. The four-legged base of the Lunar Excursion Module stood empty of the departed ascent-vehicle. The battery-powered rover was parked just as the astronauts had left it. And the United States flag remained, plastic-encased and wire-stiffened, straight out from its staff. Even the innumerable rib-treaded bootprints were as fresh as a second after they had been impressed, those many decades ago. Fresh as they would have remained for at least a million years—eroded only by an occasional micrometeorite—had the Moon stayed the breathless, moveless place it used to be . . .

On another day, Arnold and Lois flew, on a public plane, to the south-polar regions. Horton stayed behind, feeling that they should have time to themselves, without his aging presence. Let them enjoy low-grav skiing—majestic, lofty leaps, more so even than on Titan; while also being freer, more nimble on ordinary ski-costumes, no bulky spacesuits

required for breath, and for fending off cryogenic cold. And on water-snow, not congealed gases . . . Arnold seemed particularly cheerful at the prospect—almost fiercely so. Till Horton thought with easy-going humor—maybe to be rid of me a while? Or—because strain was reduced by decision? Better chance to escape at last?

If Horton hoped, it didn't turn out so, that time, either. On the second afternoon of the excursion, they arrived back at the villa in a rented heli, in good spirits, vividly clad, and full of tales of interesting events and people. Lois even displayed a small silver cup.

"Arnie won this," she boasted. "For a triple-somersault in midair, coming down. He landed almost properly, too! . . . We would have stayed longer, except that elsewhere there's something that we've got to see, before we go to Earth . . ."

So the next morning they all flew in Horton's heli to a unique place just beyond the rim of what used to be the Moon's hidden hemisphere. It was probably the most significant site of all. Already, very long ago, it had been suggested that some such find ought to—and just might—be made. This logic had been quite clear:

What better recording-medium could there be than the dust of the Moon as it had been? The lightest touch of anything with as little substance as a feather should leave a mark. Yet, in the vacuum-ambience, the marking would last in that fragile, powdery stuff as if engraved on hardest stone. Therefore, if some intelligently motivated device or being had ever—in any fairly recent epoch at least—come to the local solar system, and had even only paused on the lunar surface—as, for good, tentative examination of this family of worlds, it must . . .

Yes—an intriguing idea. Well before the lunar transformation, an exhaustive search had been made, in conjunction with other precise survey work. But only in this one, small spot had there been success. As with the Apollo site, the place had been put under a dome.

Horton had frequently come here. Though his companions had seen photographs, and all other gathered data often enough, this was their first actual viewing. This would add nothing to their knowledge—except the intangible essence of having at last been here. Of course a constant stream of other viewers with similar motives was also present. But Horton's two did not laugh, comment or question, while they looked. Unlike their usual selves, too, they were quiet and solemn.

Actually, there wasn't much to see, under that dome. Unnameable scrabblings and coilings in the unaltered dust. And many trapezoidal indentures. About these first, who really might guess with any accuracy at all? About the second, the simple suggestion was that they were foot-tracks. Utterly, emptily wrong? It was not what was visible here; it was the

unimaginable that shadowed it . . .

Affixed to the dome's flank was a white-enamelled plaque bearing explanatory paragraphs. Included in the information given—much publicized wherever humans had yet ventured—was the familiar statement that, from estimates of the rate of micro-meteorite erosion, these imprintings in the dust had occurred three-to-four million years ago.

Beside the dome was a small display case, stout and well-guarded. It contained the two artifacts that had also been found here: A bit of something like dirty cotton-floss. But silicious. And, perhaps more significant, a ten-centimeter chip or shard, apparently broken from some larger object. There were also illuminated holographs that attempted to show details of the fragment's internal structure. Even under highest magnification, this remained intricately involved and orderly, a multiplied and remultiplied lattice of cubes, tetrahedra, filaments, and spherical cavities that may have contained some important unknown that had evaporated—rotted away—whatever . . . ?

In this park where the dome was—in the pastel-blue building just beyond the eucalyptus trees—computers continued, after numerous years, to analyze, sort, compare, reassemble variously—and thus extrapolate from—already tentatively pinned-down data. With frequent referrals back to the shard itself . . . Progress, but very slow . . . Purpose of whatever parent-object from which the fragment had been shattered? . . . Kind of energy, if any, to activate? . . . What means of manufacture, or *growth?* Some dim intents almost grasped so far . . . Design and objective out of different minds and souls. Working with what might have been nothing like hands at all? . . .

Presently the three were standing a short distance back from the crowd, but with the dome in view, glinting in the sunlight.

Lois totaled the obvious, laconically:

"Somebody, or something, once came from somewhere. Anyhow the message, hoped for from way back—'You are not alone'."

Arnold's mouth curved in his wry, young way.

"Uh-huh," he grunted. "And maybe better expressed than it was, earlier, by those nine minutes and eight seconds of organized radio signals, picked up on that single occasion—when was it?—back in the beginning twenty-hundreds. Not even enough years have passed, yet, for the first of many human attempts at replying to reach any probable source at lagging light-speed. To make just the barest start at finding out very much."

He tugged at his sun-reddened earlobe, then went on:

"As for what was found here, that also said, 'Interstellar travel can be done.' So our smart people devised means. Still, as far as could be learned from very careful lunar exploration, something came to this solar system

only once in three million years. Apart from how mass is supposed to become infinite at light-speed, that pretty well proves that star hopping won't ever be swift or easy—which everybody knows."

"But can't truly know—for absolute certain," Lois commented, just a shade less solemnly.

Arnold's grin straightened out somewhat. "Yuh—all right," he conceded. "I could be prejudiced—part glad of what I just stated. Almost wishing it to be so. Not too easy. Out to Rigel in a subjective year? Across the Galaxy in ten? The universe shrunken. The charm of distance gone. Everything cheapened . . . The guts and effort taken out. Nothing accomplished . . . I might not like that, Loey. You might not, either."

His smile turned lopsided again. So was he still half jesting?

"About me, Arnie, maybe not so very soon," Lois chuckled back at him. Then her expression became almost grave.

Horton's emotions were also more than one: Surprise, exasperation, and anger at the swaggery viewpoint he had just heard from this boy—with the girl's essential agreement. A down-feeling from that. They hadn't run away, nor asked for his assistance. Nor would they. This was quite clear, from the implications in Arnold's words. Stubborn idiot! . . . Yet, Horton also had an up-feeling of refreshed approval from a residue of youthful pride and strength left in his own insides. These two would do what was required, and with appreciation of its adventurous magnificence. Anyhow, what choice did they really have—except some almost meaningless delay—between harsh necessity and gentle temptation? So had Arnold talked hard, only to make the best of what must be? While hadn't he, Horton, let sentiment unhinge his clear outlook? . . . Though was he yet entirely ready to accept this? . . .

The three were lofted back to the villa. Horton wrinkled his nose at the ticking clock that counted the hours into a progressing display of terrestrial calendar dates. For the two, only tonight, and part of the lunar tomorrow, remained for the pleasures of the garden world—if they wanted to spend a few days on Earth. They could scamper again, up to the crests of the Apennines; they could pluck fresh fruit; they could dive in the Imbrium Sea—and remember.

Haunted by the vision of frost on stilled faces, Horton did speak to them, but not now with any hope that they would be persuaded:

"Look, kids . . . If you want, you could hide a while in that old underground place. Till I might bend some ears, use what weight I can find, argue, point out facts; perhaps win a special release . . ."

They were all taking the sun in Horton's roof-garden, then.

From where they sprawled on mats, the two glanced at each other. It was a wordless communication, common between persons who are very close. The girl gave the tiniest nod.

The boy turned his head, to meet Horton's gaze. Did the laughing blue eyes say, Honest Chester, in silent mockery? Yet they had gone kindly, too. A hard hand reached out, clutched Horton's bare shoulder. The gruff voice was appreciative:

"Thanks, Old Lad. This fine world took hold of Loey and me harder than we ever supposed it would. Maybe I joshed you some. But it still does. A person can burn to linger. Yet . . . Anyhow, we'll keep in mind what you just said—hey?"

Horton chuckled back. Though he felt the rejection, gracefully done. To this, he had a considerate follow-up of his own:

"Sure, Arnie. However—look . . . Maybe I should say goodbye to you two, now? You might rather go to Earth by yourselves . . . Oh—it's okay! . . . And I've arranged . . . There's that old house—up in an area called Vermont—where I was born. The house is kept as part of the strong Cultural Preservation Program. It's inhabited by friends of mine. But they're away in South America for the cool season. I've asked and they agree. You can have it, through the Winter Solstice Festival. Which, thus, should be a real back-then experience for you both."

The girl bounded up, and rushed at Horton, then, as he had thought she might. He half arose to meet her. Their embrace was quick, real, and sexless in the common man-woman sense—though it had another.

"Chet!" she burst out in delight. "Oh—that's marvelous! . . . Chester—don't ever *think* of not going with us! You've got to! This is perfect! . . ."

Very soon thereafter, the three of them were making the seven-hour ferry-trip—somewhat crowded, queasy and uncomfortable—to the spaceport near New York. Horton, himself, hadn't been to Earth for a couple of years. Good to look around in again—if you didn't ponder sourly, and turn bitter. Muscles, always kept in good tone by rigorous exercise, soon accommodated to greatly increased body-weight, as ears did to sharpened sounds. A small plastic booster temporarily implanted in the femoral artery helped pump six-times-heavier blood.

See this, visit that . . . The inhabitants were now cooperating to do the best they could with what there was—on a whole planet that was getting to be pole-to-pole people.

The three didn't go into the Megalopolis, itself; the once-countryside was a sufficient example of how things were: Winter-chill reduced by expanding weather-control. A small cluster of neat houses here and—closely—there. Little gardens, arch-roofed with clear plastic, against possible frost. An acre-or-two patch of post-harvest grain-stubble. In every available spot amid the crowding, a tree or bush or flowers planted. Perhaps two-hundred meters off, a small, new, fumeless factory or shop . . . As near, a school, playground, cultural center, stores, commissary . . . On an

otherwise useless and rocky hillock, pines and firs growing—a dot of wilderness . . . All this, in total, a scheme constantly repeated, with variations. Each, a microcosm, with all phases of a civilization—rural and urban—much reduplicated, the different elements within easy walking distance of the others.

Was it the Japanese who, in their small and already overpopulated islands, had begun this way of life long ago? Rather nice, friendly, convenient, broad in scope. Also providing a good environment for the controlled number of children to grow, experiencing the best, without narrowness. Field, street and sky. Here, the folks tried—struggled—to keep and nurture everything that was worthy. Against fearful obstacles and difficulties . . .

Explorations of this Earth, by Horton and his companions, were not now so very extensive. Not to the still-inhabited, squalid spots. Nor to once-distant places of an opposite hemisphere. Perhaps the massive gravity did inhibit their movements, somewhat. Plus the nearness of their compelling point of interest. Most important, the short and shrinking time.

Only four days from the end, they drove up to that rambling old house. Here, let there be a kind of obsolescent peace and pleasure. For the final interval. A hopefully happy termination of a furlough and a contact.

In this neighborhood, there actually was a light dusting of snow. Inside the house were old objects and smells.

As if by intuition, the girl seemed to know her way around, here. Excitement glowed in her face; it vibrated in her voice:

" . . . And still *real* logs! . . . We've got to light the fireplace! . . . Let me do it, Arnie! . . . And there *must* be decorations! Paper bells, shiny ornaments! . . . Let's see—the folks who live here ought to have stuff like that stowed someplace! Kept from other Solstices . . . Or we'll have to go out and buy . . . Need maybe a fresh pine branch, anyhow! . . . And groceries . . . To prepare a real, festive feast! Like they used to have . . . I'll get to the first jobs as soon as we can bring back the makings! . . ."

The kitchen in this house was new and robotized; but it could also be used in the by-hand manner. After the three had returned from a sallying-forth for various purchases, this latter-day girl, in her whimsey, interest, and obscured knowledge, somehow duplicated arts of a past era. Through the house crept fragrances. Yes—of baking.

Brought oven-hot samples there in the parlor, where they sat with forgotten books and small talk, Horton met her amused and triumphant brown eyes with his own fond gaze, and burst out—though of course he had known:

"Damn! Cookies? . . . Honestly? Real cookies?"

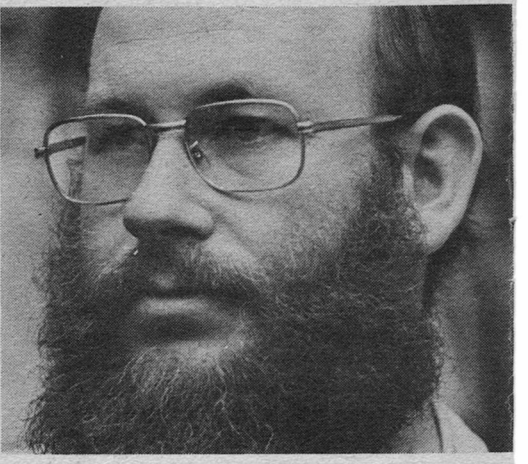
The savors he had experienced then were more than those on his tongue, at his first bite of the ancient, spiced crispness. They were more of mind and emotion, of memory, and still

silence-guarded and sense-confounding truth. They encompassed these bizarrely-shadowed two, tenderly. In the present setting, mismatched angles of time and observation had begun to seem less eye-and-mind twisting. But if awareness of his own love sharpened with a surge of pleased feeling that rightness was in this moment-and-place, then, by the same means, that darker destiny keened in his head, in vivid contrast: Young death, long lasting at least, and almost immediate . . .

So, when Lois, somehow humming contentedly to herself, had returned to the kitchen, Horton, in subdued panic, was compelled to make a final, urgent try:

"Arnold—there's enough time. We could get both of you back to the Moon. Then—if nothing else—you

● *Stanley Schmidt*



The granting of a sabbatical leave by a college to a member of the faculty for the purpose of writing science fiction may be a totally unique occurrence. Stanley Schmidt is now back on the job as assistant professor of physics at Heidelberg College in Ohio, and Lifeboat Earth *is scheduled to appear from Berkely Books. Portions have appeared in* Analog, *and the completed work is a sequel to the* Sins of the Fathers, *an* Analog *serial several years back as well as a Berkley publication of last year.*

In addition to nine years of science fiction, mostly appearing in Analog *since his first story in the September, 1968 issue, Stan's writing has been devoted to such somewhat less popular efforts, sometimes with collaborators, as "Mossbauer Effect Studies of Manganese-Tin Compounds" in the* Bull. Am. Phys. Soc. *and "Detectors and Linewidths in Mossbauer Spectroscopy" in* Am. Jnl. Phys. *As a graduate student worried about the "establishment's" views on his writing of science fiction, Stan sold three stories the first year he tried—and reports that no one in authority seemed to notice.*

Born in Cincinnati, and receiving a B.S. in Physics from the University of Cincinnati along with an M.A. and Ph.D. in Physics from Case Western Reserve University in Cleveland, Stan has been a life-long Ohio resident. He has managed to visit every state except Hawaii, often hiking and backpacking his way, with mountain climbing and cave spelunking thrown in. He has played baroque, dixieland, and classical music on an assortment of instruments in churches, bars, and symphonic orchestras. Photography and flying are among his other hobbies. And Stan is prepared to read fan mail or other correspondence in German, Dutch, Spanish, Portuguese, French, Italian, Russian, and Swahili.

BIOLOG Jay Kay Klein

could go to Mars. Certainly they'd accept you—considering your background. Also, I could go there again, sometimes, myself. It's not really so far . . ."

Fleetingly, as he spoke, Horton pictured Mars as it had become: Orbiting reflectors of thin magnesium-foil already mostly in place, to increase surface-sunshine, deficient because of distance. The climate warming considerably, hidden water-ice becoming liquid more than vapor in the moderately-increasing atmospheric density . . . Most people living there didn't want to change their planet as much as the Moon. In the still-rarified air, pressure-supported coverings of thin plastic would continue to be necessary. Plenty of original desert wilderness would still remain . . .

Arnold met Horton's words with an indulgent good humor. Though a muffling hand had gone to the monitoring device on his lapel.

"Chester," he said, "I know I told you we'd keep it in mind. But there never was much real doubt . . . Look—I think I liked your Garden-Moon more than Loey did. Yet even then I felt it would cloy on us—turn too sweet. Being out-fronters—part of the leading edge—a cocky lot . . . Sure—I suppose Mars would accept us. Loey and I have been through that idea. But what is Mars? Known, not new. Not really wanting us, either—we being second-rounders now, too—thus intentionally infused with increased pioneer spirit. For a movement that has got to start. Even so, in coming time, the means of outward movement might prove much too slow to keep up with even much more restricted population growth, producing disaster in this solar system . . . Anyhow, here's our position, Loey's and mine—what's got to be, supported by what we really want, risks and all . . . You know what I think she's after, most? An open world, where she's free to have a few kids, with nobody to tell her not to. Sure, I'm part of that . . . And of course the whole huge thing comes together—not in mind, maybe, but a bigger kind of scheming—plan—natural law—biology. As certain as how the universe expands physically . . . So, Chester—that's where we are."

Horton jerked his head, as if, again, to jar loose some nonexistent defect in his aging eyesight. He felt as if he had tried to jolly an innocent—this Arnold—or maybe himself? When neither person quite fitted the definition. The voice that had just spoken now seemed gruffly, kindly wise.

The snort that Horton gave was like an explosive laugh, at some ridiculous anecdote:

"Yuh!—I am aware . . ."

This included the sharp clarity that he would lose these two. Acceptance. Still not quite peace . . .

The last days passed agreeably. Horton saw the girl in a flowered apron, which she had found somewhere. Tongues remained compulsively restrained in certain areas.

The three had their private celebration. Dinner-goose, and the rest of the

antique formula and customs. As gifts, Horton gave two costly wrist-companions—each an exact chronometer, a radio-communicator and an advisor-computer, all miniaturized as a unit to be worn. Out there and then, they should be useful.

Horton received a brightly-ribboned packet of homemade sweets. Also, a ridiculous, historic treasure of incalcuable worth. He had seen it often before, in a childhood experience. Of all improbable objects, it was a dried-out and blackened golfball that one very early Moon-visitor had clubbed away into the lunar scene as a joke . . . Still hard to grasp how this boy and girl had it to give? . . . Horton spoke his thanks to both, for all they were, and might yet be.

Old brews and songs took their proper part. With the tumults stilled, it was a fine occasion in most ways. It was the ancient Winter Solstice Celebration, so necessary, once, to cultures that had to pass through a cold, confining season. On Earth, many still called it Christmas.

For these two, New Years wouldn't come. Anyway, not now.

There was a moment when the girl asked mildly:

"So, Chet—how will things go for you?"

Almost a rhetorical query. Like hers, Horton's words had to lose a little of their inhibition:

"Well—I've got seven more years to complete my allowed first round of a hundred-and-eleven. Then, I suppose, like the others . . ."

He thought of the most significant advance of this era—among the parallel ones. His body would be immersed in a warm, gelatinous fluid, multiconstituted: Nucleic acids, long-chain molecules which were biotic building blocks. Nutrients. And with guiding factors—hormonal triggerings, controlled ion-flow . . . Double-helix structures . . . From the fluid, living filaments would grow, and grope into his flesh . . . Cell-cloning for restoration . . . Even the brain cells, dying off gradually, and not replaced during his long life, would be compensated for by an equal number of new . . . At the end of about seventy terrestrial days he would reemerge, almost as he had been at his early best, but remembering much. Though with some small—designed and chance-personality-differences. Then—denied his home—where? Mars would probably be closed to him by that time. So Ganymede, frozen. Titan? . . . Or, under hardship conditions, to build a cyliner-planet? Or Venus, at last opened up? Or much farther . . .

Horton, looking at the two young faces, across the parlor of his own birth-house, exhaled breath from his nose. He felt better. Yet with joy, worry, sorrow, fact and misaligned memory, and magnificences continuing to stir in him . . .

Next morning, he journeyed with his guests to the Outward Center near Boston. In a waiting-place crowded with young people—many were truly that, having chosen by their own will and lusty drives, the three sat for a

little while, not saying very much, like most of the others present. Until the two looked straight at each other.

"Hey!" Arnold chided mildly. "This isn't *really* an execution."

"I know," she agreed in complaint. "But while you hang around for anything, wondering when, it can feel that way! Some small situations can get more solemn than they deserve."

As if startled by her own remarks, she chuckled. He was drawn into the mood. In a second, they were laughing together. Horton decided that this was part of their enduring unity. He laughed, too.

At intervals, there were musical chimes, followed by the calling out of names. Presently those of this pair. They stood up, again in their frayed, blue coveralls—their fine clothes left behind, useless and frivolous. Yet not poor, Horton thought, in their shared eagerness and courage, and their natural keeping together. Like few in their restless clan in this struggling age. Solid. A talisman . . . Aware, too, that within perhaps three hours, they'd be inert cargo ready for the starship awaiting in Earth-orbit.

Horton walked with them the few steps.

"You just might come to us again, Chester," Arnold remarked.

"Yeh—like once before," Horton mused. "Long chance. Within—say—two hundred years? . . . Unless, by my time, the main goal will be some other star-system than Sirius? . . . Procyon? . . ." He paused.

"Yes, Chet?" the girl prompted. "We have to break the spell—or complete it. Bring the funny, crooked pieces together . . . No secret—never was. And it has been out, now, for quite a while, in our talk . . . So the bit we avoided speaking of—because it seemed too weird to accept—too strange to disenchant . . . Out loud. Plain . . . Even if we're not quite ready? Last chance . . ." Her lips were parted.

It still didn't exactly fit. He—Horton—old. And this smiling, teasing girl. This fierce youth . . . Though there were clear signs . . . Something his guts balked at grasping, even yet. In part as if it might offend them. A comedy thing . . . Yet a dark charm! This impossible becoming common. Best symbol of this wondrous, dangerous, distorted era. To appreciate. Though the risks were more splendid than ever.

In a moment these two would leave him, for their prolonged, personal Ice Age, and a distant chance. Horton began speaking:

"Goodbye, good fortune. And is it all right to add—"

The arcane words had been inscribed playfully on the exchanged gift-packages. Now Horton said them:

"Gram and Gramps?"

A hard hand tightened briefly on his shoulder. The rough laugh was almost remembered: " . . . Some joke, hey, Chester, Old Lad?"

The girl kissed Horton's cheek lightly.

"As long as it's true," she said. ■

continued from p. 11

does create myriad internally consistent systems of natural law of great complexity, subtlety, and beauty, any one of which might be the true one that truly describes the workings of the real, objective universe. The creation of any one of these systems represents a feat that only a powerful mind could perform. The problem, however, is obvious. There is no way to determine which of these wondrous products of the human mind describes the universe that we actually live in except by comparing each one *through experiment and observation,* to the world that we actually live in.

What does all this say about the application of the methods of science to government and to economic life? What do people commonly think it says? A scientist is apt to say that it means that conditions should be carefully specified and tightly controlled. I greatly fear that an individual scientist, no less than any other individual, if he had the power to run the country would attempt to run it as one single huge experiment, attempting—for the good of us all, of course—to regulate all of our actions. This is indeed the popular image of a "scientific government" and it is the image that George Orwell conjured up when he wrote "1984."

On the other hand, it is the image that J. Bronowski movingly refuted as he stood by the crematorium at Auschwitz and said, "When people believe that they have absolute knowledge, with no test in reality, this is how they behave. This is what men do when they aspire to the knowledge of gods. . . . Science [on the other hand] is a very human form of knowledge. We are always at the brink of the known, we always feel forward for what is to be hoped. Every judgment in science stands on the edge of error, and is personal. Science is a tribute to what we can know although we are fallible. In the end the words were said by Oliver Cromwell: 'I beseech you, in the bowels of Christ, think it possible you may be mistaken.' " [3]

A truly scientific government is one based upon the assumption that you or I or anyone else may be mistaken. It is not organized like one big experiment, but like thousands. It is not run by a Hitler or a Central Committee or even, except in a limited sense, by an elected Congress. It is "run" by the summed results of thousands of experiments.

Science tends to be identified now with "the system." It is accused of trying to impose conformity and wring all the diversity and mystery out of life. But the truth is the opposite. The essence of science is to constantly challenge the system. It is not opposed to the individual who would experiment. It is only hard on the individual who, upon an insufficient experimental base, attempts to erect yet another system.

Another image of a scientific gov-

[3] *J. Bronowski,* The Ascent of Man, *Little, Brown and Co., 1973, p. 374.*

ernment that we should discuss, a somewhat more benign image, but more insidious, is a government run upon the basis of computer models. Computers have an enormous ability to process data, and it is often assumed that if enough data is fed through a computer, it will print out truths. Closer to the truth is the observation, "garbage in, garbage out." "A recent attempt is reported to analyze problems of international detente by feeding 1200 factors into a computer. Such readily numericized factors, of course, do not exist. . . . It is impossible even in principle to design a computer that could cover all the potentialities of even a chess game, for it can be shown that such a computer would need more units than there can be particles in the entire universe. And a chess game has rules in the sense that international politics does not."[4] Even in the numerically exact sciences, computer models must be used with the greatest caution. Computers cannot generate new truths; they can only refine old ones.

So! Having disposed of what a scientific government is not, what is it? It is one that maximally promotes experiment, of this I am sure. Beyond this, it is wise to be humble. In the case of science and the arts, the archaeological record suggests that centralized authoritarian regimes most often promoted experiment. Perhaps, however, the record is misleading. One wonders how an archaeologist of the thirty-eighth century digging into the eighteenth might compare a beautiful and intricate clockwork toy from the tomb of Louis XIV with the rusty iron hulk of Watt's steam engine unearthed in the British Isles. Which civilization might he consider had most promoted experiment? Which civilization do you consider did so?

Problems of interpretation notwithstanding, there is a considerable amount of archeological and historical evidence to the effect that in the basic sciences and the arts, activities the produce of which are not readily salable, experiment is best assured by providing money. And, as often as not, the best source of that has been an authoritarian government commanding large resources. In my own technical speciality, the Russians are ahead. I, therefore, along with other technologists, have reason to be inclined toward that sort of government.

But, I have wandered the streets of Moscow, browsed through its stores, been to its theaters, visited its laboratories, and seen something of the surrounding countryside, and after a little while the dearth of innovation and experiment begins to make me itch. When it comes to innovation and experiment by and for the common man, there is no comparison whatsoever between ourselves and them. Nor, with few exceptions, can they compare with us in any branch of science or technology or art or litera-

[4] *Robert Conquest,* The Wilson Quarterly, *Spring 1977, pp. 156-157.*

ture or anything else. Their system is ridiculously rigid. They can never catch up with us until they change their form of government—or we change ours. They cannot possibly surpass us because if they were out in front with no one to follow, they would not know where to go next. Harsh, dogmatic, unprovable statements these. But I believe them and so, obviously, I believe that the American form of government comes closer to being a scientific government than does that of the USSR, claims of the USSR to the contrary notwithstanding. It makes scientific sense for an individual to make up a five-year plan for his own experiment. It makes no scientific sense for a government to make up a five-year plan for all its citizens—a distinction of deadly significance. Forgive me if I belabor the point, but it is so important. If, in the exact sentence, even provisional truths are only obtained after carrying out a multitude of experiments, then the idea of a premier or a president, a presidium or a congress making decisions for us all in the vastly more complex and fluid soft sciences is patently absurd. Absurd, that is, unless the decisions are of a certain sort, by which I mean decisions that encourage rather than inhibit experiment. What might these be?

In the last two decades, our government has vastly increased its regulatory activities. In 1976 there were seventy-seven federal agencies engaged in regulating some aspect of private activity. It is not obvious that they have solved many of the problems that they were formed to solve. It is obvious that they have discouraged private initiative and often resulted in its misdirection. Granted that there were ills that needed correcting; there were and are other possible courses of action. Charles L. Schultze distinguishes two ways in which society can handle a problem: ". . . social intervention can be *process-oriented*, seeking to correct the faulty process, or *output-oriented*, seeking to bypass the process and determine the outputs directly by regulation or other device." He goes on to observe that "social intervention has almost always been *output-oriented*. . . . And this has been a costly bias. It has taxed, well beyond its limit, the ability of government to make complex output decisions." [5]

Mr. Schultze cites the following examples of *process-oriented* intervention (what I would term "experimentalistic" or perhaps simply "scientific" intervention): Assistance to higher education through aid to individuals who can then "buy" education where they choose, rather than direct subsidies to universities. A stiff penalty for high industrial injury rates rather than detailed stipulation of safety regulations for each industrial workplace, thus leaving to each firm the job of how best to maximize safety and minimize cost to the consumer. In

[5] *Charles L. Schultze,* Harpers, *May 1977, pp. 43-62.*

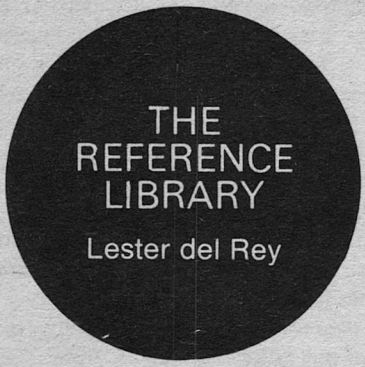
connection with conservation, he notes that market incentives and the price system, whatever their ills, do tend to direct invention toward conserving those resources which are scarce. With respect to pollution he notes that the future of society is going to hinge on the discovery of ever improving technology to reduce environmental pollution, not on the legislated imposition of existing pollution control technology. "Reducing pollution has to become a paying proposition rather than a set of regulations to be fought and delayed. . . . In designing the techniques of social intervention, the historically demonstrated power of marketlike incentives to influence the pace and direction of technological change warrants every effort to install such incentives in our social programs." Granting that the market is an imperfect instrument, he notes that regulatory schemes are also, and it is on this basis that the two should be compared.

Our present greatest problem seems to be energy. Experimentation to solve the problem would unquestionably be spurred by the deregulation of fuel prices—a politically unpopular act. Unquestionably, it would hurt. If I had the power to do it, I'm not sure I would. But it would likely work. Two hundred million inventive Americans would likely solve the problem while two hundred or so bureaucrats will likely not. Two thousand years of the history of science make that pretty clear.

A truly scientific government, then, is one that, as a rule, does not solve problems. Instead, it endeavors to set up conditions conducive to their solution by its citizens rather in the manner that a good manager of a research laboratory endeavors to set up conditions conducive to creativity among his employees. As a minimum he endeavors to minimize rules and regulations and maximize communication.

Sad to say, most actions of government from time immemorial have tended to do the opposite. As a result some suggest that the federal government should be abolished altogether. It does seem like a marvelous simplification. However, it is hard to believe that the abolition of one center of inordinate power would not merely lead to the growth of other centers of inordinate power. Better that we regain control over the one we have. We can, if we try. The lessons of science teach us that the centralization of decision-making power that exists in other countries and grows daily in ours is not just unpleasant but silly. It will not solve our domestic problems. It will not keep us ahead of the Russians. It will not work. It never has.

We must establish a new principle of government. I believe that that principle should be the one that has so effectively governed science, . . . and that is the scientific method which, if properly understood, is approximately described by the term "experimentalism." ■



OF TIME AND THE RIVER:
To end the suspense that seems to have plagued a great many readers, let me announce at once that the third Riverworld novel has finally been published! This is **The Dark Design** by Philip José Farmer (Berkley/Putnam's, 416 pp., $9.95).

A lot of time has passed since the first two books in this series first appeared in 1971. During the years since then, I have received quite a few inquiries from readers about various things connected with science fiction—not to mention some on astral projection, religion, and other related subjects! By rough estimate, eighty percent of those ask, "When will the next Riverworld novel appear?"

Or at least, that's the way the question was phrased at first. Later, the queries were simplified to the less hopeful, "Will the next Riverworld novel ever appear?"

I could get no definite answer, even from the author. While time went by, everything was in abeyance. Apparently there was some disagreement between publisher and author on how the rest of the story was to be done. As I gathered, the publisher was unwilling to continue the series in the length that Farmer felt he needed. (This disagreement, incidentally, had nothing to do with the present editor for the publisher.) I found such reluctance hard to understand; most publishers who find themselves with a successful series are delighted to keep it going as long as they can. But at any rate, six long years went by without the third book seeing print.

Ordinarily, after so much time, public interest begins to die down and readers forget. But that certainly wasn't the case this time, judging by the inquiries I received and comments from booksellers who were still finding a continually increasing demand for the book.

Perhaps something like the long delay should have been expected. The whole history of the story of the Riverworld is one of delay, difficulty, and bitter defeat for the author's hopes.

It all began in 1953, almost a quarter century ago. Shasta Publishers was running a contest for the best new novel submitted, offering $1000 of their own money and $3000 from Pocket Books for the paperback rights. This was a princely sum for a science fiction novel in those days.

At that time, Farmer was just establishing himself as a major writer, one with quite unusual ideas. For the contest, he came up with the idea of having all humanity—everyone who had ever lived and died—resurrected along the banks of an enormous river on an obviously artificial world; how they got there the resurectees could not guess, except for Richard Burton, who had caught a glimpse of what went on behind the scenes.

The boldness of the concept and the drama of Burton's search for the truth behind the resurrection were detailed in a novel of about 100,000 words. The novel won the contest, with much publicity and great promises of early publication. (This original version was entitled *I Owe for the Flesh.)*

Then the publisher began stalling, claiming that the novel had to be rewritten to please the editors at Pocket Books. Farmer rewrote the novel twice, and still did not receive his money. Then he learned that Pocket Books had accepted the book as it was and had paid in full to Shasta long before. None of this money ever reached Farmer, since Shasta collapsed. The book remained unpublished. And Farmer, who had naturally counted heavily on the money due him, was forced to abandon his writing career and get a regular job.

This is probably the ugliest event in the history of science fiction.

Twelve years later, some of the story received publication in a changed form. Fred Pohl was editing the Galaxy Publications, and he read the book and suggested that Farmer turn it into a series of novelettes which he could publish. (At one time, I actually had the original manuscript in my hands; I picked it up from the office to take it to Pohl at his home. But, damn it, I didn't realize what I had, so I didn't sneak a chance to read it.) A lot of time had passed and Farmer had more ideas to add to the original, so the new series grew to be longer than the original novel. Then he recast the novelettes into two books, which were finally published as *To Your Scattered Bodies Go* (which won Farmer a much-deserved Hugo) and *The Fabulous Riverboat,* the second centered about Mark Twain's efforts to build a steamboat to navigate the river. But the solution to the mystery behind the Riverworld was still to be settled in later work.

Then, unfortunately, came the impasse between Farmer and his publisher, while readers apparently waited with very little patience.

Well, *The Dark Design* is finally with us. It's a much longer book than the previous two—nearly as long as both of those together—and brings the total wordage up to about three times that of the first version. And it still doesn't tell us the promised secret of the Ethicals and what lies behind the whole concept of the Riverworld!

There's more to come.

This is a more complex book than the previous ones. The first dealt with Richard Burton, the second with Mark Twain. This new volume deals with both of them, while also introducing a number of new characters who must work out their strange destiny. And there is a rather strange hiatus between events that we saw before and the beginning of the new book. Much time has passed. It is now more than 30 years after the first day of resurrection. And one of the major features of life along the River has changed.

Previously, whenever anyone who had been revived was killed in the numerous fights or accidents during the early days, he was again resurrected somewhere else along the ten-million-mile length of the river. Now this no longer seems to be the case; death, it is believed, is final. Burton, who had used "the suicide express" to cover most of the River, must now guard his life as carefully as any normal man back in the days of Earth. He has returned to the group with whom he began his trip and is now continuing down the river in a boat.

Meantime, Sam Clemens has departed. At the end of the second book, he'd just finished his first riverboat, to have it stolen by wily King John. But in the intervening years, apparently he has managed to construct his second boat, the Mark Twain, and to take off down the River in pursuit of his betrayer.

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Twain's "colony" at Parolando, where the technology to build the boats was developed, is now in the hands of a man named Firebrass, who apparently died in 1984. There he has been joined by Cyrano de Bergerac, among others. And there comes Jill Gulbirra, who plays a central part, and who died in 1983.

Watch those dates, incidentally, when you read the book. And don't expect to find out exactly why you should watch them! But there's something strange going on. Burton had apparently discovered that Earth was destroyed sometime after the year 2000. But, while the population kept increasing and there should be hordes who died toward the end, there seems to be a shortage of people who died after 1983; and among those who gave dates after that for their demise, some at least are suspicious characters.

Among other new characters who are important in this novel are Jack London and Tom Mix. They are joined by Peter Frigate, another major character. He appeared as a companion of Burton at the very beginning—or someone with that name did. But hold on to your hat.

Frigate is with Burton—has been for many years—on his current trip down the River. And things grow suspicious suddenly; Frigate disappears from Burton's company as a result in 32 A.R.D. (After Resurrection Day). But Frigate—or a man with that name, Peter Jairus Frigate—joins with London and Mix in 7 A.R.D. In the past, he was apparently a writer, one who had written a great deal of science fiction. To belabor what seems obvious, you might check his initials against those of the author of the book. Anyhow, he seems to be two characters, one of whom is probably a real person.

Complicated? That's only the beginning, folks. Obviously, there's a lot more to what goes on in the Riverworld than has shown in the first two books. (If nothing else, the character who appears at the very end of this book is evidence that there is a great deal more to come about which we—and Burton, among others—know very little yet.)

The first book dealt with Burton, who tried to reach the end of this twisting and redoubling River by committing suicide or being killed and then being resurrected—hoping in one return to life to be near the River's end. The second dealt with Sam Clemens-Mark Twain who wanted to reach the end of the river by building a riverboat and steaming downstream. This book details a different approach to reaching the goal, and a more logical one.

The River is about ten million miles long, which would make for quite a voyage. But since it loops back and forth in great horseshoe bends, the distance across it to the source is measured in only thousands of miles. Obviously, the sensible course must be by air. (Overland travel is impossible because all the river is embanked in impassable mountains.)

So Firebrass and his crew at Parolando are now building a dirigible—really a zeppelin that will make the Hindenburg look like small stuff indeed. It's the logical solution to the problem of reaching the headquarters of whatever group lies behind all the things going on, of course.

And despite strange betrayals and

hugo winners

Analog contributors again took the lion's share of Hugo Awards at the Thirty-Fifth World Science Fiction Convention (SunCon) in Miami Beach over the Labor Day weekend.
Spider Robinson's "By Any Other Name" (November 1976 issue) and Joe Haldeman's "Tricentennial" (July 1976 issue) were voted the best novella and short story, respectively. Haldeman had received a Hugo the previous year for his novel, THE FOREVER WAR. Rick Sternbach received the Award as Best Professional Artist, and Ben Bova won his fifth straight Hugo as Best Professional Editor.

Isaac Asimov's "The Bicentennial Man" was voted the best novelette. Kate Wilhelm's WHERE LATE THE SWEET BIRDS SANG won the Hugo for best novel.

C. J. Cherryh received the John W. Campbell Award for Best New Writer. Andre Norton received the Gandalf Award for Grand Master of Fantasy. Like the Hugos, the Campbell and Gandalf Awards are voted on by the science fiction fans themselves.

Hugo winners Asimov (left) and Bova at the Analog office.

SETH W. ROSE/JIM CALLANAN

stranger confusions as to who is and who is not trustworthy, the airship works. I'm not giving away anything when I tell you that Firebrass and his crew do reach their goal. Let's say simply that they don't find yet what they are seeking, exactly. And there's a lot more to the book than their trip.

If Farmer knows what's behind all this, he must be having a marvelous time confusing us with it. (After all this time, I'm pretty sure he knows exactly what goes on; if not, I may strangle him before other readers can!) And so far, I think the readers will have a marvelous time being delighted and confused by his inventions.

I have a number of reservations. I rather resent having Sam Clemens left without a ship in the second book and finding him happily cruising down the River in the third—having completed his second boat offstage. I wish the second book had been long enough to show him at least making a good start toward building the next boat.

And I'm rather less than delighted with some of the attention paid to Jill Gulbirra. She's a perfectly good character, but to me she remains something of an extra, not having as essential a part to play (so far, of course) as most of the other major viewpoints. It strikes me that she may have been given more than her due to give us a "female-lib" person, not because the story itself demanded it. I'd rather have seen more of Cyrano, for instance, who is a totally delightful character as he masters the fine art of handling modern technology.

And one little detail kept annoying me—particularly early in the book—as I read. Farmer is converting to the metric system, so everything is given in feet and meters. Okay. But the method is unnatural. I'd guess that Farmer got himself a calculator and very carefully figured each of his conversions. Thus, if he gives a rounded-out figure in feet, he gives far too exact a metric equivalent. A mile is translated to 1609 meters, say. Somehow, that felt awkward; the metric unit should also have been as approximately natural as the English unit—say rounded to 1600 feet. If we approximate a height of 20,000 feet, why make it 6098 meters? It would seem more natural to say 6000 meters—or 6100, if more precision is needed. A typewriter is enough machinery in the writing process; adding a calculator is just a bit too much, dearly as I love the gadget!

Still, this Riverworld is a really grand creation—one of the greatest inventions of science fiction. And *The Dark Design* adds a great deal to it. It's a book no reader should miss. Let's hope the next book doesn't take so long to be published. I'd like to finish the whole series before I die of old age.

And speaking of the works of Philip José Farmer, there's another series of his again available—and one that shows the fine inventive turn of mind he has in a quite different form. This is his "World of Tiers" series. These began in 1965 and numbered five books altogether. (For some reason, I never found the fifth, so I'm hoping to rectify this lapse soon.)

Ace Books, in its most welcome new policy of putting the best of its backlist out again rapidly, is now issuing

the series on a one-a-month basis. So far, **The Maker of Universes** and **The Gates of Creation** are available (247 pp. and 188 pp. respectively, each $1.50.)

These books deal with a decadent race who once mastered all science. Each Lord, as he calls himself, can now literally build himself a private universe—a pocket universe, as it is called—to his own design and with its own laws of physics. The first book shows us Robert Wolff being called into one of these universes—a world laid out something like a Babylonian ziggurat. The Lord had peopled it with all sorts of mythical beings, abducted from Earth or created. And now the Lord is missing, and the universe is going to hell in a hurry. Wolff and the mischievous Kickaha the Trickster set out to rescue damsels and restore order. It's a romp of adventure and marvelous inventions. After that, the second book takes off on another wild romp as the Lords fight each other in their own vicious way through a perfidious ubiquity of pocket universes.

The books are totally lacking in significance, relevance, or symbolism—and they are just pure fun to read.

I wish I could say the same for another Ace book—**Space Visitor** by Mack Reynolds (149 pp., $1.50). But the idea is simply too tired to survive. A world about to go into convulsions of warring great powers has a base on the Moon. One day, a scientist from that base returns to tell them he has discovered an alien ship. However, he claims he's buried it under a rockslide and he refuses to tell where it is. They bring him back to Earth, and he still refuses to tell where it is. And if you've guessed the ending from that, you are unfortunately quite right.

At most, the book—with lots of space and large type—may run to 40,000 words. At $1.50, that mixture of quantity and quality can only be considered a ripoff.

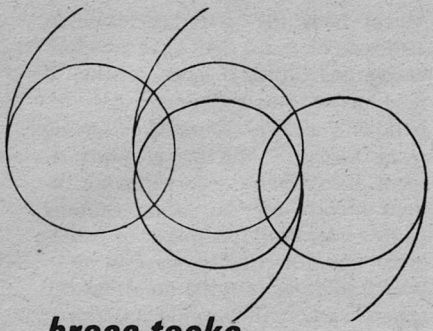
For a real example of how to waste your money, however, take a look at—but DON'T BUY—**AB to Zogg** by Eve Merriam (Atheneum, 43 pp., $5.95). They call this thing "a Lexicon for Science-Fiction and Fantasy Readers." And it's full (well, sort of; there's not much per page, mercifully) of such enthralling entries as Hershebehemoth and Ritipox and Wockups, with the *ke-you-test* definitions relating to absolutely nothing having anything to do with science fiction or fantasy.

Apparently Merriam thinks that fantasy and science fiction are made up of nothing but gobbledygook terms without any referents. The blurb says she has captured some of "the most elusive whimsy of science fiction and fantasy"—but there's no evidence internally that she has ever seen a book of science fiction.

It's enough to turn any child who gets it off fantasy or science fiction forever. Isn't there a law about misrepresentation in advertising? If not, this should cause one to be passed—and enforced, in this instance.

Carry a woops bag with you when you go to look at it.

The really sad part of it all is that Atheneum has published some of the very best fantasy and science fiction for young readers that is currently available. How could you, Atheneum? ■



brass tacks

Dear Mr. Bova:

I am fifteen years of age, just recently subscribed to your magazine, and this is my first letter.

I only saw the "Analytical Laboratory" once, in a copy of Analog which I bought off the newsstand. I purchased a subscription, and was shocked to see that the ANLAB was no more.

But hope springs eternal, and in the October 1977 issue, I saw a letter advocating the return of the ANLAB. Right on!

There is also another advantage to having the ANLAB appear only annually or semiannually. It would eliminate "impulse voting," to coin a phrase. Voting on impulse is caused by reading a gimmick story, believing it has more value than it possesses. On the spur of the moment, you might note for this story, then forget its existence inside of a week. Six months will allow the reader to sort out the "gimmicks" from the superlative works, voting accordingly.

This seems to add a sense of literary justice to a feature which should be returned to the pages of your magazine.

Keep up the good work!

MICHAEL WEANER
1050 Westchester Avenue
Napoleon OH 43545

Okay! We've received several letters "seconding" the idea of an annual Analytical Laboratory vote. So send in your ratings for the best stories of 1977, and we'll publish the results—if we get a statistically significant sample. And how about rating novels, novelettes, and short stories separately?

Dear Ben:

I have been following with interest the discussion in Analog regarding orbiting space colonies/industries.

It may well be that considerable manufacturing will be performed on the Moon's surface, rather than in orbit, especially since a mining camp must be established anyway to provide the raw materials for an orbiting colony. However, it seems to me that for many industrial processes an orbiting location would possess a number of advantages.

One factor in this would be weightlessness of orbit (other than small tidal forces). The Earth and the Moon possess considerable gravitational fields which exercise a distorting influence on many delicate processes—semiconductor crystalization, for example. Skylab clearly showed this when the men there successfully grew a semiconductor many times larger than possible on Earth. In orbit, gravity is completely controllable, from zero up to the limits of a centrifuge.

Another factor is energy. On Earth,

conditions are such that solar power is capital intensive. The atmosphere reflects 50% of the incoming light, and so collection areas must be larger than otherwise. Since the Earth rotates, expensive provisions must be made for the collectors to follow the Sun across the sky while resisting the distortion of the Earth's gravity. Since half the time the Sun is not visible at all, the collection system must be still larger and possess sufficient storage capacity for the night's requirements. And the system must be able to withstand earthquakes, storms, and other disasters.

On the Moon the situation is not quite so bad. There are no storms, few quakes, no atmosphere. However, a solar energy system on the Moon still suffers from the need to be strong enough to withstand the lunar gravity while having to follow the Sun across the sky, and there must still be sufficient storage capacity for the night (2 weeks long this time). These problems are sufficiently acute so that many who have studied the provision of power for the lunar mining camp have decided that the best answer for the camp is nuclear power.

In orbit, solar power is freed from these problems. Structural requirements are very low, and the collector can permanently face the Sun. There is no atmosphere to reflect away light, and there is no night (other than an occasional eclipse). As a result, solar power becomes the obvious cheap energy source for an orbiting manufacturing facility.

Another factor is vacuum. Good, cheap vacuum is extremely desirable for many industrial processes, and in space vacuum is as easy as opening a faucet. Now, the Moon has very little atmosphere, but it does have a considerable gravitational field, capable of holding an atmosphere of sorts for periods variously estimated ranging from weeks to millions of years. It seems likely that any considerable human facility on the Moon (mining camp, industrial complex, or whatever) would inevitably outgas a number of volatiles into the lunar "atmosphere", where they would collect and then stabilize at some equilibrium, losses to space balanced by new gas released. (I do not mean that the base will try to pollute the lunar "air"; simply that gases will escape from the mines, factories, and living quarters past the best human seals.) Although this "atmosphere" would be a hard vacuum for most purposes, there are still many processes for which this would not be good enough, and orbit would then be the obvious place to locate these.

Finally, regarding solar power from space for the Earth, possibly there will turn out to be deleterious ecological consequences, or perhaps new technology will make it obsolete, or perhaps for some other reason it will not be chosen to power Earth during the next 50 years—but we simply *don't know* enough at this stage to say. There are advantages, as I've gone over above, to locating solar power facilities in space, and there is presently no evidence that microwaves are harmful to the ecology. However, even if something does turn up and solar power from space to Earth is never used, it still seems clear that orbit is the location of preference for a number of important industrial and scientific processes, and that the ener-

gy source of preference for an orbiting facility is solar.

Thanks for listening.

MICHAEL MCNEIL
P.O. Box 183
Berkeley CA 94701

And it seems equally clear that a Near Earth Orbit is preferable to a location at L5, for economic, safety, and logistical reasons. Mining on the Moon, manufacturing in NEO. What do we need L5 for?

Dear Mr. Bova,

Ordinarily I am not a letter writer (a failing, perhaps, on my part), but I feel I must take some exception to your editorial in the April, 1977 issue of Analog. On general principles I am in hearty agreement with what you said. There is little doubt that our government is no longer of, by, or for us. And in large part, we do have no one to blame but ourselves. We seem to be in the process of abdicating our sovereignty to a group of politicians and bureaucrats who haven't the foggiest idea of what is going on in the "real" world. They legislate and regulate as if they operated in a vacuum (not such a bad place for them) and rarely give any consideration for the impact their machinations will have on the country as a whole.

However, I do take exception to your general indictment of "Big Business" for messing up the system by lobbying for their special interests. It sounds as if you were suggesting that business were the only vocal and powerful special interest group around. This is just not so.

I would like to point out that our present Congress may be described as generally pro-labor. And for a powerful, vocal special interest group, organized labor is by far the strongest. Much of the legislation coming out of Congress (whether inacted or vetoed) is favorable to labor, and inimicable to business. Which, very simply, is why business is more and more lobbying for its interests.

I do grant you Big Business is not without its sins. There can be no moral or economic justification for arbitrarily setting aside the safety and well-being of employees or a community just to increase profits. But, I do not think this to be a situation that is widespread. Most large corporations are responsible institutions with a sense of responsibility to the world they operate in. Their primary function is to make a profit. That way they perpetuate themselves. And in the process they create the jobs we need, goods and services we require, and new and (hopefully) better products. Businessmen are not angels, certainly, but neither are they devils. And a general indictment of them, without reference to other groups equally powerful and interested in forcing through special interest legislation, is unfair and shortsighted . . .

JAY GANNETT
265 Alamosa
Hewitt TX 76643

Organized labor does often behave exactly like major corporations, in that both tend to set prices for their goods or services that are independent of the existing marketplace forces. We live in a controlled economy . . . controlled by corporations and labor unions.

Dear Ben:

I thoroughly enjoyed Sam Nichol-

son's story, "A Rat of Any Psize," in your March issue. I felt, however, that his concept of psionic fields didn't go far enough. If individuals can be said to comprise a field of some sort then so can those combinations of individuals we call groups, organizations, societies and so on. Further, if things which are extentions of an individual's personality such as his clothes are part of his psitronic field then, similarly, the objects which are extentions of social relationships would be included within socionic fields.

From the broader view of socionics (the study of socionic fields), psionics is just a start. Mr. Soomb's rattrap is the key to something both quite remarkable and potentially dangerous.

HAROLD SCHLEGEL
1209 W. Morse
Chicago, IL 60626

Do you think we should keep such machines away from Washington?

Dear Mr. Bova:

Referring to the Editorial of your April 1977 issue, congratulations. You have generated one of the most incisive analyses of the structure of power in this country that has seen print. The left groans of the inequities of the system and the right moans about the "insiders" who really manipulate the strings of government and business and, while they congratulate themselves and snipe at each other and at nameless forces while the machinations of government are left to those with something better than mouths for weapons.

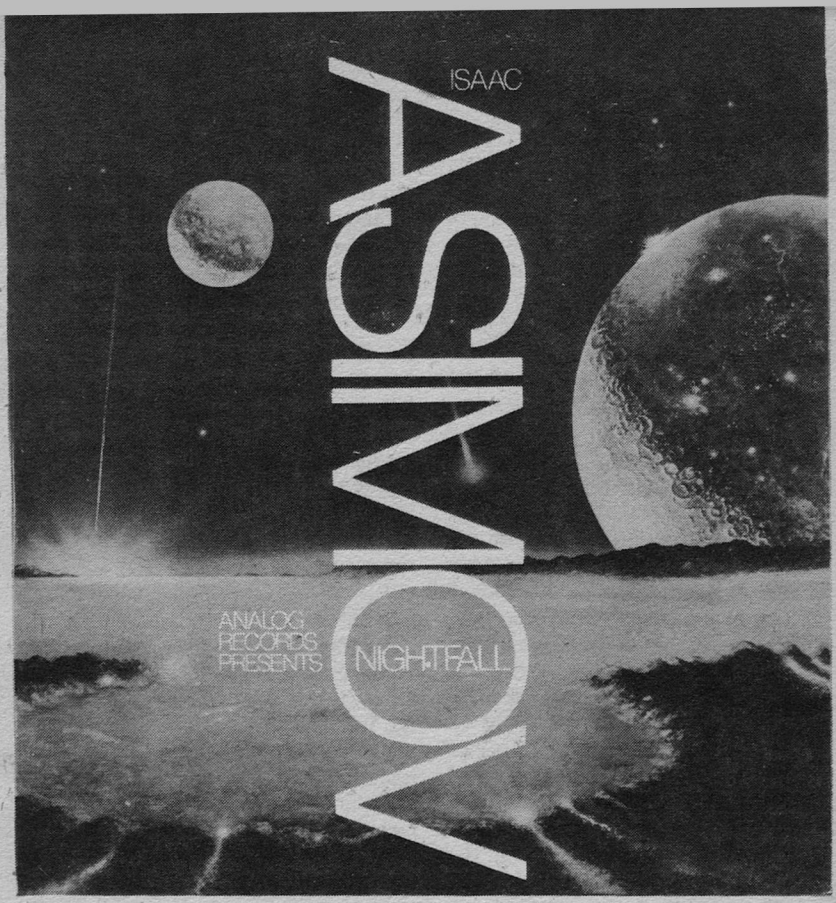
We have the power to make it happen if we—enough of us—get off our duffs and campaign, write, work, boycott, vote, and telephone. All this takes time. Time could scarcely be better spent. I wonder if you haven't hit on a problem in science fiction and other speculative activity. Whenever that essential problem appears on the literary landscape, its solution tends to come in the form of a benevolent despot, an enlightened elite of scientists or sociologists or whatever, or an expedition of extraterrestials (shades of Magellan) who bring solutions with them. You have said it all. Any of the precious freedoms God gave us for our learning—by use or misuse—are for our activity, for our exercise and growth; not for us to surrender to the first sugardaddy that comes along.

"Any American who is dissatisfied with the way his or her Government is operating, and who has not actively worked for a candidate, joined the local party structure, or ever written a letter to his or her congressional representatives—that citizen deserves whatever Government we are getting." This is true. Even those of us who have done some or all of those things shouldn't feel too smug. For, though we may have done more than most; have we done all we could have, all we should have, all that our talents and capabilities demanded of us? How much can a nation be shaped by the activities and inactivities of its populace? I don't know, but I'd very much like to find out.

Thank you again, Ben Bova, for the truth. I second the emotion.

CHARLES H. COLLINS, JR.
58 Main St.
Chester NJ 07930

It takes a lot of time and energy to be effective in politics. But politics is too important to be left to the "pols."



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Dear Mr. Bova,

I just finished the crying jag that hit me about ten pages from the end of "Stardance" by Spider and Jeanne Robinson. (March 1977). It started off in trickles as I began to be *really* sure of the time of Shana's finale . . .

I had read Spider's stories of Callahan's Bar with great delight and a few wistful smiles at certain points. I read "By Any Other Name" thinking "So he can write the not-so-light stuff, too," but it didn't really impress me. "Stardance" impressed me in an extremely sensitive spot. While I have no claims to being anything better than an amateur storyteller who does it in the medium of improvisational (mostly) dance, and that in my dubious spare time, it calls me strongly and my soul would die if I could no longer dance. There are a number of things that would denude my life of color if I lost them, but I think dance is at the top of that list. The urge, the need, *God,* do I understand in the worst way Shana's need for time, time, just a little bit more time so she could finish those dances. It hurt when I knew what the price of completion was, and knew how much I'd feel it was a just and fair price, if only I could do as well.

Well, if this story doesn't win a Hugo in the appropriate category, someone—a great many someones—are very insensitive. There is always the possibility that a more moving, better written story of the same length will be written this year, but somehow I find that easy to doubt. I felt much the same emotional upset at the end of George R.R. Martin's "A Song for Lya". Both stories hit me in very sensitive spots. While I enjoy a well-written story which gets inside my defenses occasionally, I am very glad that they are as rare as they are—I don't think I could withstand the assault if they weren't.

ANNE-MARIE FOURNIER
209 Oberlin
Claremont CA 91711

The emotional impact of "Stardance" is unquestionable. And the Robinsons also pulled off the very difficult technical feat of describing in words the ultravisual medium of dance—without boring or confusing the reader!

Ben Bova;

By way of introduction, I learned to read from the Bible at the age of four, 1942, I was given my first copy of Astounding SF in 1943, it has first place in a long line of subsequent issues. Over the years many of the editorials have disturbed me, particularly those on education, because of the inherent pessimism and tendency to criticize without offering constructive suggestions. As a 1954 High School dropout who finally graduated in 1974, I enrolled at Cal State Univ. at Los Angeles in 1975. Since then I have sat, as a student representative, on many committees. Both campus and statewide which deal with educational policy and faculty development. I must admit that I am very optimistic about the long term prospects for education in this country.

Diana King, in her guest editorial, states that "education,—, appears to be in a state of crisis and transition,". I couldn't agree with her more. Since the end of the second world war, education in America has gone

through several transitions. In the 1950's, a period which the Carnegie Commission (1973) refers to as the Golden Age of higher education. The emphasis was on selective education. The demand for access to post-secondary education was so great and the available facilities so limited that the onus for creating an outstanding class of educated students was not placed on the teaching staff, but was instead achieved by the method of selection used by the admissions staff. Pedagogical problems were minor in such a homogeneous student body. The 1960's saw equal opportunity rather than elite selection as a priority. Thus was ushered in the era of financial aid based on need, open door admissions, and record numbers of matriculated students. But no change in pedogagy. The same Carnegie report (1973) calls the 1970's the time of troubles. People are not only asking Diana Kings question, "What are we educating people for?" But are we educating people at all. Research clearly shows that there are different learning rates, learning styles, motivations and talents. Yet, still, we continue to utilize pedagogical methodology which turns out students who are educated and those who are not, but we certify that all have spent the same time at the task. Bloom (1976) has shown that anyone may master a skill given sufficient time and assistance. And thus, hopefully, we set the stage for the 1980's. What some future commission will name them I do not know. I would hope for the years of competency.

Mastery learning, based on the theory that knowledge is cumulative and sequential, requires that each student master each step in turn before proceeding to the next step. Under mastery conditions approximately four-fifths of the students are able to reach a level of competency attained by less than one-fifth under non-mastery conditions (Bloom 1976, Cross 1976). These concepts as expressed in personally scheduled instruction and the Keller Plan are increasingly becoming the model for higher education. The sheer idea that the majority of our young people are capable of doing Cum Laude work will shock many traditionalists into Ms Kings' "future-phobia", but how great it would be to live in an age when eighty percent of our population was truly educated and the other twenty percent only half a step behind. (sales of Analog should skyrocket) I don't believe it will happen tomorrow, revolution in the educational process takes about twenty years to bear fruit, but I do believe it will happen.

ANDRE SHAMBARGER
Administrative Assistant to the Associated Students vice President
C.S.U.L.A. 90032

P.S. I gave up rose colored glasses many years ago, and was not wearing a pair while I wrote this.

This letter is reproduced exactly as it was written. Who will teach the teachers? And their administrators?

Dear Mr. Bova:

As much as I may respect and admire the excellent work that Lester del Rey has been doing in The Reference Library, his comments in the April issue force me to disagree with him.

He stated, regarding the new SF magazine, Unearth, that there was really no need for a magazine featur-

ing only stories by unpublished authors, since the better-paying markets were all eager for new authors, so any new author would first submit there. This is largely true, I'll admit, but he fails to consider those authors who are as yet too unsure of themselves to submit to the big markets . . . [and] develop their talents until they get up enough skill and courage to submit to Analog. The stories are not Hugo contenders, to be sure, but neither are they as bad as Mr. del Rey said them to be. Just because Analog is the best and the greatest in the field is no reason for him to disparage the efforts of newcomers to the field. This points out yet another reason for welcoming a new addition to the field. Since editorial tastes differ, a story rejected by several other editors may still be good enough to warrant publication. So each new magazine enriches and strengthens the field. With these thoughts in mind, I hope that Mr. del Rey will also review the two other new zines, Galileo and Cosmos.

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There are two dangers in store for new writers when they send their stories to anything less than the best markets. One: they miss the chance to break into the best markets right away. Joe Haldeman, George R.R. Martin, Spider Robinson, Jerry Pournelle, Lisa Tuttle, P.J. Plauger and legions of other young writers gained quick recognition by daring to send their stories to the toughest markets available. Two: it is very tempting to continue sending your stories to an "easy" market, once you've been accepted there. A writer might be tempted to continue selling stories to the "easy" market and never get up enough courage to try the tougher ones. Several fine writers have never gained the large audiences they deserve because they have never sent their work to larger marketplaces.

Dear Mr. Bova:

In case you get any complaints about "Selling the Promised Land," you can tell them that at least one slightly reactionary Catholic enjoyed it. The only thing that kept me from laughing too much was that it was too close to the real situation of religion on the tube: the program that, as far as I know, is the most successful right now is one that's run on a tonight-show type format, only you get to phone in your prayer-requests. But I donbt that *Wandering Padre* will do as well as *Kung Fu,* unless Father Malone gets to call down the wrath of God upon sinners in the last five minutes of the show. (That's an important part of media-religion. And come to think of it, did you notice that Chang Caine managed to avoid mentioning that he was a Zen Buddhist?)

As "religious" films go, I prefer *2001* or *Logan's Run* or even *Dracula has risen from the Grave* to, say, *The Omen* or *The Exorcist* or *Anything by Cecil B. DeMille.* But maybe that's my upbringing.

DON SCHENK

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One man's proselytizing is another man's evangelism. As for "religious" films, for most of them, the closest connection with religion is the reverence the producers have for box-office receipts.

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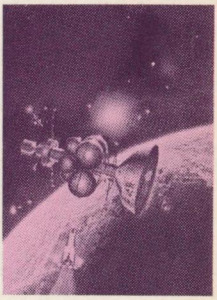

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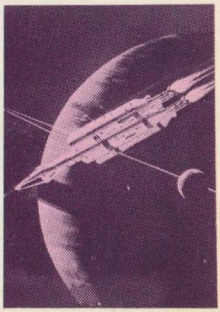

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