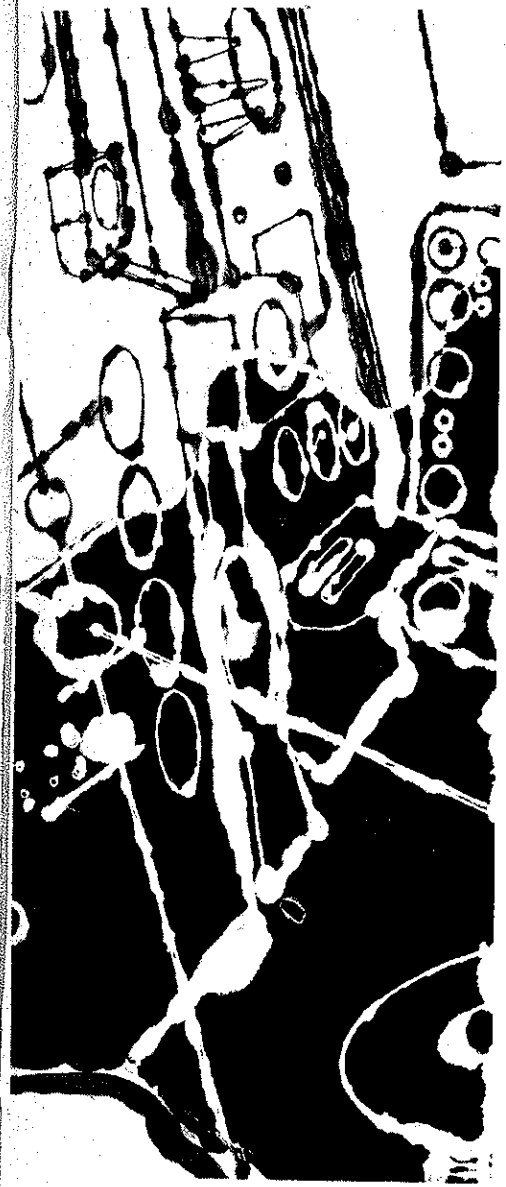
The Mapmakers

By FREDERIK POHL

Before any ship could span light-years in a single jump, hyperspace had to be charted—though Man was blind in that awesome chaos!

Illustrated by ASHMAN



IT was one of those crazy, chance - in - a - million accidents. A particle of meteoric matter slammed into *Starship Terra II* in hyperspace. It was only a small particle, but it penetrated three bulkheads, injuring Lieutenant Groden and destroying the Celestial Atlas. It couldn't happen in a hundred years—but it had happened.

That was the end of the road for *Starship Terra II*. The damage-control parties patched the bulkheads easily enough. But the Atlas—the only record on board of the incomprehensible Riemannian configurations of hyperspace—was a total loss.

The Captain gave orders for Spohn, the Celestial Atlas, to be buried in space and called an emergency officer's meeting in the wardroom.

Terra II was in normal space and free fall. A trace of smoky kerosene odor still hung in the wardroom, but there was none of the queasy unrecognizable slipping motion of the hyperspace "jump," and the Captain had ordered the ship spun to give them a touch of simulated gravity. The officers were managing to look alert and responsive as they faced their skipper.

THE Captain was a hard-muscled, hard - eyed career naval officer, and by definition

an ambitious man—else he would hardly have asked for the command of a charting flight. He walked briskly in from his own quarters, neither hurrying nor slow. He would walk at that same pace to receive his admiral's stars when that day came, or to his execution, if it ever came to that.

He assumed his place at the head of the table and took the precise ten seconds his martinet mind allotted him for looking around the wardroom. Then he said, "We're in trouble."

The men in the wardroom hitched their hips a quarter inch closer to the ward table.

The Captain nodded and said it again, "We're in the soup, and we're a long way from home, and nobody is going to come to get us out of it. We'll have to do it ourselves, if we can. Ciccarelli's trying to get us a fix, but I can tell you right now, we're not close to Sol. There isn't a constellation in the sky that you or I or anybody else ever saw before. We might be a hundred light-years from home, we might be ten thousand."

The Exec cleared his throat. "Sir, what about our records?"

"What records? They went with the Atlas, Hal. We can't retrace our way to Earth."

"No, sir, that's not what I mean. I understand that. But our charting records from Earth to here, we still have those. They won't do us any good, because we can't follow them backward —hyperspace doesn't work that way. But Earth needs them."

"Sure. What can we do about it? If we could get them back, we could get back ourselves. The whole trouble— Yes? What is it, Lorch?"

Ensign Lorch saluted from the door of the wardroom. "Spohn's body, sir," he rapped out. "It's ready for burial now. Would the Captain like to conduct the services?"

"The Captain will. What about Groden?"

Lorch said, "He isn't good, sir. He's unconscious and his head is bandaged up. The surgeon thinks it's bad. But we won't know for sure for at least a couple of hours."

The Captain nodded, and Lorch quickly took his seat. He was the youngest officer on *Terra II* in years, six months out of the Academy and still unable to vote. He listened to the discussion of ways and means with deference masking a keen feeling of excitement. The adventure of the unknown star lanes! That was why Lorch had signed up in the charting service, and he was getting it.

Perhaps more, even, than he had bargained for.

THE trouble with *Terra II* was that she was playing a cosmic game of blind-man's-buff. Jumping into hyperspace was like leaping through a shadow, blindfolded; there was no way of knowing in advance what lay on the other side.

The first hyperspace rocket had taught a few lessons, expensively learned. On its first jump into hyperspace, *Terra I* had been "out" for just under one second—just time enough, that is, for the jump generators to swing the ship into and out of the Riemannian n-dimensional composite that they called hyperspace for lack of a better term.

And it had taken *Terra I* nearly a year to limp back home, in normal space all the way, its generators a smoldering ruin. Back still again to the drawing boards!

But it was no one's fault. Who could have foreseen that any electric current, however faint, would so warp the field as to blow up the generators? The lesson was plain:

No electrical equipment in use during a jump.

So *Terra I,* rebuilt, re-equipped and with a new crew, tried again. And this time there were no power failures. The only failure, this time, was the human element.

Because in hyperspace, the Universe was a crazy-quilt of screaming patterns and shimmering lights, no more like the ordered normal-space pattern of stars than the view through a kaleidoscope is like the colored shreds of paper at its focus.

So the Celestial Atlas was added to the complement of a hyperspace rocket's crew. And *Terra I* was rebuilt, and *Terra II* and *Terra III* and *Terra IV* came off the ways. And Earth cast its bait into the turgid depths of hyperspace again and again. . .

The crews of the charting service were all volunteers, all rigidly screened. The ten officers that made up the wardroom of *Terra II* were as brilliant and able a group as ever assembled, but the emergency officers' meeting was a failure, all the same.

There just wasn't any way back.

"We're the trail-blazers," rumbled the Captain. "If we had a duplicate Celestial Atlas—but we don't. Well, that's something for the next ship to bear in mind, if we ever get back to tell them about it."

ENSIGN Lorch said tentatively, "Sir, *don't* we have one?"

The Captain rasped, "Of course not, man! I just finished saying we didn't. You should know that."

"Yes, sir. But that's not exact-

ly what I meant. We have a Library and, as I understand it, the Library is basically the same as the Atlas—a trained total-recall observer. Doesn't any of the information in the Library duplicate the Atlas?"

"Now that," said the Captain after a pause, "is worth thinking about. What about it, Hal?"

The Exec said, "Worth a try, Captain."

"Right. Yoel, get her up here." Lieutenant Yoel saluted and spoke into the communications tube. The Captain went on reflectively. "Probably won't work, of course, but we'll try anything. Anybody else got a suggestion?"

"Dead reckoning, sir?" Yoel suggested. "I know we've got the record of our fixes so far; can we try just backtracking?"

"Won't work," the Captain said positively. "If we could be absolutely exact, maybe. But without an Atlas we can't be. And a centimeter's divergence at the beginning of a run might put us a thousand kilometers off at the end. A thousand kilometers in hyperspace—heaven knows what that might come to in normal space. Anything from a million light-years down.

"I couldn't do it, Yoel. Even Groden couldn't do it *with* his eyes, and he's the best ship-handler on board. And I don't think he's going to have his eyes, anyway, at least not for a long time. Maybe forever, if we don't get back to the eye banks on Earth. Without the Atlas, we're as blind as Groden."

The speaking tube interrupted and rescued Yoel. It whistled thinly: "Recorder Mate Eklund reporting to the wardroom."

"Send her in," said the Exec, and the Library, Nancy Eklund, RM2c, marched smartly in to the meeting.

IT wasn't going to work; the Captain knew it in the first few words. They spent an hour sweating the Library of all of her relevant data, but it was wasted effort.

The Captain thought wistfully of Recorder Mate Spohn, the lost Celestial Atlas. With him on the bridge, hyperspace navigation had been—well, not easy, but *possible*. For Spohn was trained in the techniques of total recall. The shifting, multicolored values of Riemannian space formed totals in his mind, so that he could actually navigate by means of a process of mental analysis and synthesis so rapid and complex that it became a sort of *gestalt*.

Of course, a twelve-stage electronic computer could have done the same thing, just as quickly. But *Terra II* had its limitations, and one of the limitations was

that no electronic equipment could be operated in a jump—just when the computer would most be needed. So the designers came up with what was, after all, a fairly well tested method of filing information — the human brain. By the techniques of hypnotic conditioning *all* of the brain opened up to subconscious storing.

Recorder Mate Spohn, trance-like on the bridge, had no conscious knowledge of what was going on as, machinelike, he scanned the Riemannian configurations and rapped out courses and speeds; but his subconscious never erred. With its countless cells and infinite linkages, the brain was a tank that all the world's knowledge could hardly fill — just about big enough, in fact, to cope with the task of recognizing the meaning of hyperspace configurations.

And the process worked so well that the delighted designers added another Recorder Mate to the personnel tables—the Library—which enabled them to dispense with the dead weight of books as well.

The entire wardroom, in order of rank, shot questions at their Library, and her disciplined mind dutifully plucked out answers.

But most of them she never knew. For *Terra II* was a charting ship, and though the Atlas had, as a matter of routine, transcribed his calibrations into the ship's log—and thence into the Library—all that Nancy Eklund knew was how *Terra II* had reached its checkpoints in space. Hyperspace was a tricky business; backtracking was dangerous.

When *Terra II* got back—*if Terra II* got back—those who came after them would have complete calibrations for a round trip. But they did not. Their task was as difficult and dangerous, in its way, as Columbus' caravels. Except that Columbus had only one great fear; falling off the edge of the Earth.

Lucky Columbus. The technology that had produced *Terra II* had brought plenty of new fears.

THREE shells "up" — toward the ship's center—a surgeon's mate named Conboy was pulling the fourth needle out of the arm of Lieutenant Groden. The big navigator should have been out cold, but he was tossing and mumbling, his head thrashing from side to side in its thick wrappings of bandage.

Tough guy, thought Conboy critically, counting up the ampoules of opiate the blinded officer had taken. They were all tough guys, anyway, from the Skipper on down. But the little

pipettes brought them down to size and Conboy, though only an inch over five feet tall and the frailest on board, was the man who drove in the pipettes.

"He's under, Mr. Broderick," he reported to the ship's surgeon, who nodded.

"Keep it so," the officer ordered. "If anything comes up, I'll be in the wardroom." The Captain would be wanting to hear about Groden's condition, and Broderick wanted very much to hear what the emergency meeting had to say about the condition of *Terra II* in general.

This was fine with Conboy, who had a similar concern of his own. As soon as Commander Broderick was out of sight, Conboy took a last look at Groden and, reassured that the navigator would be out of trouble for at least half an hour, hurried to the next cabin to pry what information he could out of the chart room.

A Spaceman-First named Coriell was methodically taking optical measurement on all the stars of second magnitude or brighter. Conboy looked uncomprehendingly at the entries on the charts. "Got anything?" he asked.

Coriell spat disgustedly. "Got trouble. See that little fellow down there, between the two real bright ones? That *might* be Canopus. The rough lines check; Mr. Ciccarelli's going to have to run a spectrum on it, when he gets through with the meeting."

Conboy looked sourly at the indicated star. It was brighter than the average, but far less bright than the two that flanked it. "Canopus, huh?" he repeated. "Suppose it is, Coriell. How far from Earth does that put us?"

Coriell shrugged. 'What am I, a navigator? How's Groden, by the way?"

"He'll live. Suppose it is, Coriell?"

"Well—" Coriell thought for a moment. "Depends. If we're on the same side of it as Earth, might not be far at all. If we're on the other side—well, Canopus is six hundred and fifty light-years from Sol."

Conboy looked again, longingly. "Well, thanks," he said, and went back to his patient.

That was the trouble with hyperspace travel, he thought. You go in at one point, you rocket around until you think it's time to come out, and there you are. Where is "there"? Why, that's the surprise that's in store for you, because you never know until you get there.

And sometimes not even then.

ON the bridge, everything was Condition Able. Ensign Lorch, booted early out of the meeting because he was due to relieve as Junior OOD, signed in and made his tour of the ship. The damage control parties belowdecks were all through with the necessary repairs, and keeping themselves busy with such cosmetic tasks as fairing down the beads left by the first emergency welds. It was hot down there.

Lorch conscientiously whistled up the bridge on the speaking tube and ordered them to start the fans and valve enough gas into the expansion locks to make up for the heat rise. The crew quarters were shipshape, even the women's section; the jet chambers were at stand-by, with the jetroom hands busy at their usual stand-by task of thumping the tubes for possible hidden cracks. The working parties were finishing up the job of restowing the cargo that had to be shifted when the meteorite hit.

Lorch signed in the log, and paused thoughtfully over the spaces for entries of course and position. The helmsman was smartly at attention at the main board, though there was nothing for him to do since all jets were capped. Lorch glanced at him reprovingly, but the helmsman was conspicuously correct in his behavior.

It made a problem; Lorch detested the thought of writing in "unknown," but it certainly would be exceeding his authority to call the chart room without the permission of Lieutenant Yoel, his shift commander. Not, thought Lorch a trifle rebelliously, that Yoel was likely to object very strongly.

Yoel was a drafted mathematician, not a ship-handler. He knew very nearly all there was to know about geodesic theory and the complex equations that lay behind the "jump" generators and their odd nucleophoretic drive. But he was far from a model officer, so little conscious of the fundamental law of R.H.I.P. that he was capable of presuming to advise the Captain on ship-handling—the scene in the wardroom had proved that.

LORCH had just about decided to call down to the chart room when Yoel appeared, signaling that the meeting was over, and Lorch deftly dropped the problem in his superior's lap. "Ship on Condition Able," he reported briskly. "No maneuvering during watch; no change in operating status during watch. I have made no entry for course and position, sir. Thought you might like to."

"I wouldn't," Yoel said sourly. "Put down 'unknown.' Write it in big letters."

"As bad as that, sir?"

"As bad as that." Yoel turned

his back on his junior and methodically scanned the segment of sky outside the port. It was in constant spinning motion, flashing past the field of vision as *Terra II* whirled on its axis to give the crew something approaching gravity.

Lorch cleared his throat. "You got nothing out of Eklund, sir?"

"Oh, sure. We got the absolute magnitudes and stellar distances of half the stars in the Galaxy." Yoel turned from the port and shook his head. "We got a short course in Riemannian geometry and an outline of the geodesics of n-dimensional space. But we didn't get a road map." He glanced at the thermometer on the wall and said vaguely, "I thought I heard—"

He stood up straight. "*Mister* Lorch!" he exploded. "I wasn't hearing things! You were bleeding air into the expansion locks!"

"Why, yes, sir. To cool the ship," Lorch explained. "The welding torches were—"

"Blast the welding torches, mister! Did it ever occur to you we're a long way from home?"

"Yes, sir, but—"

"But you're an idiot! But! You valve air off as though we had a whole world of it. Did it ever occur to you that we might be in space a long time? Did you stop to think that we might run out of air?"

Lorch stared at him wordless. For a frozen moment he thought his superior had gone mad. Spaceships? Spaceships ran from point to point. In n-dimensional hyperspace, no point was far from any other—an hour's travel, perhaps a day's. *Terra II* was crammed to the gunwales with air, by the standards of the service. Run out of *air?*

II

"EASY, Sam." The voice came floating up at Groden out of blackness. Something was wrong, and he was lying down; he grunted and started to get up.

A hand stopped him. The voice said, "Easy." He fell back, and felt nothing as he fell. His whole body was numbed, only a faint tingling sensation where it touched what he was lying on. Drugged, he thought. The voice said, "Sam, don't try to open your eyes. Can you hear me?"

It was like making a statue speak, but he got the word out, "Yes."

"Good. You've been hurt. A meteorite hit while we were in hyperspace. Got the Atlas, and something got you right across the eyes—drops of molten metal, by the scars. You're—you're blind, Sam. At least for now."

"Yes," he said, after a moment. There was a very special sort of tingling around the eyes.

"Maybe we can fix you up when we get back to Earth. But we're lost, Sam."

Lost? Groden pondered that. Lost. It didn't make sense. Of course, if the Atlas was dead—But still, how could they be lost? He strained to hear what the voice was saying; but it had gone on to something else.

Soothingly. "Now, Sam, this is going to hurt. We've got to change the dressings." Business of tingling, and more tingling of a different sort, but not anything that Groden could call painful. And then, suddenly and surprisingly, it hurt very much. He tried to speak, but the voice said, "Easy, Sam. It will only take a minute." Silence and pain. "Now, I want you to tell me if you can see anything at all, Sam. Any light? Even a flicker when I pass the light over your face?"

Light? Groden stared into the painful blackness. There was nothing, nothing at all, neither light nor flicker nor motion. He said through the lips that were still tingling marble, "No."

The voice was disappointed. "All right, Sam. I'll stop the pain in a minute." Another voice farther away was saying something about getting stowed away for the jump and the voice that had talked to Groden said impatiently, "Just a minute."

Groden licked the marble lips and tried to say, "What did you mean, lost? What's the matter?" But it came out a blur. The voice said something short and insincerely reassuring, and then there was a special pricking tingle in his arm, and even the voices were dark.

"SECURE," ordered the Captain, and the Exec relayed the word through the speaking tubes: "Secure!" One by one the sections reported in on their tubes —All secure.

The Captain had taken the conn himself, and he had the bridge on the jump. Lieutenant Yoel was backing up the helmsman, the navigator Ciccarelli was staring dubiously at the whirling stars, Ensign Lorch was hustling along the light-up detail, as they, with painstaking slowness, adjusted the hollow wicks in the running lamps. The odor of kerosene filled the bridge.

"All secure, sir," the Exec reported.

The Captain said curtly, "Kill the spin." The Exec gave the order to the jetroom; there was a distant barking rattle, and the bridge complement, like standing wheat in gusty wind, staggered and caught itself. The spinning stars outside jerked unevenly to a stop as the ship steadied on its axis.

Lorch cast a quick look around. The chronometers were wound and synchronized; the kerosene lamps burning brightly. He saluted the Exec and reported all clear. The Exec nodded gravely and passed the word on to the Captain—all of a yard away.

The Captain said, "Take us up, Hal."

"Yes, sir. Number One circuits open!"

The watch officer relayed into the speaking tube: "Number One circuits open!" There was a flicker, and abruptly all of the fluorescent lights were out. Only the kerosene lamps illuminated the bridge, or any of the ship.

"Number Two open," said the Exec.

"Open Number Two!" Yoel echoed into the tube. From all over the ship the distant drone of motors, fans and refrigerators and boosters and burners deepened and died.

"Main circuit breakers open." That was only a precaution. Every electric current in the ship had ceased to flow; but in the off-chance that something, somewhere, still was drawing juice, the mains themselves were opened. *Terra I* had taught that lesson very well; electronic flow and the hyperspace field did not mix.

The Exec, looking a little gray, said, "Stand by to jump."

"Stand by!" Yoel sang into the

generator-room tube. The far-away moan of the nucleophoretic generators shook everyone in the ship; even on the bridge, they could feel their subsonic grind and hear the rumble of the Diesels that drove them.

The Exec was rapidly scanning his panel of instruments, his lips moving. Everyone on the bridge could see his lips move, and knew what he was doing; making sure he had the readings memorized. Once in hyperspace, it would not be precisely impossible for him to read them, but it wouldn't be reliable.

At the feeler chart table where the Celestial Atlas should have been standing, Recorder Mate Nancy Eklund stood with her fingers on the pits and ridges that represented the coded course analyses. Like the Exec, she was doing her best to memorize them, in the last moments before vision became unreliable and instruments began to lie; it was her last chance to see them as a whole.

The Exec had its eyes on the big chronometer. As the second hand touched straight-up, he said, "Jump!"

Far away, the Diesels complained, as the generators clutched in. The ship shimmered and glowed. A high, thin *beep* sounded from nowhere. Outside the crystal port the universe of stars flickered and whirled into new and fantastic shapes.

And, half the ship away in the sick bay, Lieutenant Groden screamed shrilly.

ENSIGN Lorch tried shutting his eyes, but the flaming pinwheels had left scars of blankness on the visual purple of his retina. He blinked to clear away the darting after-images. When he opened them again, the images were gone, and lashing serpentines of light peered ferociously in the port. The writhing snakes squirmed away and the planet Earth lay before him, green and inviting.

It was only an illusion, but it was an illusion the whole bridge saw at once. Lorch looked away and heard the voice of Nancy Eklund, droning her course coordinates to be repeated by the Exec.

Illusion, illusion — only the voices were real. It had to do, Lorch thought fuzzily through the wonder, with light speeds and partial radiation vectors and null-polarity; but the words meant nothing when the reality was before his eyes.

"C" became infinite and finite at once, creepingly slow and immeasurably fast. Light trapped on the outer surface of the port crept through to them at last, movement appeared fast or slow

or reversed, or irrelevant to its real components.

He could see the Captain, stolid and transfixed like a bronze man —but was he? Or was that motionless metal figure really leaping about the bridge, and what Lorch's eyes beheld only the image of a split-second, captured and pinned? He could see the navigator, Ciccarelli, floating dreamily a yard above the floor; *that* was illusion and symbol, for the little magnets in their shoes made it impossible. But what reality, translated, did it represent?

Light and electrons. In hyperspace, they lied.

"Number Six, Number Ten," droned the Exec, echoing the Library. "Full reverse." The voices did not lie; the grosser physical phenomena were immune to the distortion of Riemann's continuum. What they heard was what was there to hear. What Nancy Eklund felt with her fingers was real. Lorch saw, or seemed to see, that the Exec had his finger on the pulse in his own wrist, timing their jets-on periods by his heartbeat.

The spring-driven chronometer across the bridge was clearly visible and undoubtedly telling the correct time. But the light that carried its message might lie, and the fingers that touched his pulse would not. "Off jets!" droned the Exec.

THEY hung there. This was what Ciccarelli and the Exec and the Old Man had worked out —lacking the Atlas, lacking Groden—working only from their memories of the course that had brought them into the meteorite's orbit and the sketchy notes the Captain himself had made.

If they had remembered everything with the eidetic recollection of Eklund or the Atlas; if they had every component correct, and could stay on course for the proper period before halting their flight; they might—*might*—come out where they had started, and from there easily find their way home.

There was motion and activity on the bridge while they waited; and Lorch observed that Ciccarelli had kicked loose his shoes to float high enough off the steel floor to touch the hands of the chronometer. If he was floating now, thought Lorch, it was no lie of the light. And was what he had seen a moment before the image of *now*, received before it was sent?

They waited, and asked themselves such demented questions, while *Terra II* described the complex curve that passed for a Riemannian straight line, and the Exec thoughtfully counted his heartbeats.

Then: "Full jets, One, Four, Five Main," snapped the Exec.

The ship bucked and shuddered.

And then it was over, and they came "down" out of hyperspace, down into the normal space-time frame that held their own sun and their own planet. They had backtracked, as near as could be, every component of their course. And they had come out.

They stared wordlessly at the stars, until the Captain said briskly, "Belay that. Take a fix, Mr. Ciccarelli!" And down in the sick-bay, little Conboy, able once more to trust his vision, was rapidly assembling a hypodermic. But as he turned to his patient, he saw that it wasn't necessary; Groden, who had been mumbling and crying out throughout the jump into hyperspace, was out cold again.

CICCARELLI put down his abacus.

"No position, sir," he said throatily to the Captain. "We've checked everything down to third magnitude."

The Old Man's chin went up a degree of arc, but that was all. "All right," he said. "Keep going."

"We'll try, sir," Ciccarelli promised. "I'll get right to work on the faint ones."

The Captain nodded and walked delicately, almost mincingly in the light spin-gravity, away. Commander Broderick from the surgeon's office down the corridor replaced him. He was staring after the Captain, as he came into the navigation room.

"If I were the Old Man," he said thoughtfully, "I would still be here."

"Maybe that's why you aren't the Old Man." Ciccarelli wearily leaned over his crewman's shoulder to scan the rough log.

"Maybe," Broderick agreed. "Still, what's he going to do back on the bridge? Go through this same routine again? Make another jump and see where we come out? Might work, I don't deny it. Given infinite time *and* infinite fuel and a couple of other infinites, sooner or later we'd come out right spang in the middle of the Brooklyn Navy Yard."

"Tell him your troubles," Ciccarelli said shortly. "How's Groden?"

"He'll live. If any of us do."

"That," said Ciccarelli, picking up the completed sheaf of observations from his crewman, "is a pretty long shot, Doc."

The Captain, in his own mind, would have agreed with Ciccarelli. He walked soberly, unswervingly, down the galleyways toward the bridge, ticking off the posibilities with a part of his brain while the big, deep area that might been labeled "officer's country" was making careful note of the ship's condition.

The fuel and food reserves would outlast the air; and Broderick's sick-bay was an Asiatic mess. Lacking the Atlas's data and Groden's skill on the bridge, it would take a miracle to get them home; and Spaceman-Second Kerkam was out of uniform.

The enlisted women's quarters needed floor-polishing; and the mind of no three-dimensional animal could, by definition, grasp the geodesics of Riemannian space. It was a matter of trial and error and record, and all you could hope to do was retrace a course once you had found one that brought you somewhere worth being. It was, he reflected with mild distaste, a shoddy way to run a spaceship.

RECORDER Mate Eklund, having ducked into the enlisted women's area scant yards ahead of the Captain, sighed to her bunkmate, "Thank heaven! I thought he was coming in here!"

"Did you have a rough time on the bridge?" her bunkmate asked sympathetically.

"No, not that. But he's a fish, Julia. He was just standing there, not looking scared or anything, and all the time we were going straight to—straight to goodness knows where. *He* doesn't know what to do," she added bitterly. "None of them do."

"You think we're lost?"

"Think it? Honey, I *know* it." She sat down and complained, "I've got a headache."

"I wouldn't be surprised," her bunkmate said warmly. "Here, let me get you a cup of tea."

Nancy Eklund said doubtfully, "Do you think you should? Every time you boil water, it's just that much more heat. And—"

"Now let me worry about that," said Julia. "You're a pretty important person on this ship, and you've got to keep yourself in good shape."

The Library let herself be persuaded easily enough, though she had an idea that her bunkmate had an ulterior motive or two. But she *did* have a headache and she *was* tired.

And it was true that on the bridge during a jump, she was about the most important person aboard.

It was a duty that Nancy hated, though, important or not. She thanked her lucky stars that most of the time she was in a trance state and not able to observe, for instance, what the distortions of hyperspace were doing to her own personal appearance. But it was finicking, wearing work, even in a trance state. Some of it was bound to seep through to the conscious level, however distorted, and she had been having dreams about hyperspace courses, fixes and triangulation points.

Julia came back with the tea and Nancy Eklund said, "I'm sorry to be always complaining. Heaven knows it's no worse than we had a right to expect. We knew this was dangerous when we signed up for it."

"But we didn't know we'd sweat ourselves to death, Nancy! We didn't expect this eternal should-I-light-the-lights, should-I-boil-some-coffee. Honestly, I don't mind dying half as much as I mind being nibbled to death by one little annoyance after another!" She glanced speculatively at the other girl, and in a different tone said, "I guess you're pretty tired—"

Nancy Eklund sat up and stared at her. "Julia! You can't want me to go on with that horrible story."

"Not if you don't feel up to it," her bunkmate said humbly. "But it passes the time—if you aren't too hoarse."

"Well, no." Nancy took a sip of tea. "I was receiving, not putting out," she said professionally. "I suppose if you *really* want—"

"Index!" said Julia triumphantly, not waiting for her to change her mind. As Nancy Eklund, at the cue word, slumped into the trance state, Julia caught the cup of tea before it spilled. "Fiction!" she said, and went on to give the author's name, the title and the chapter of the mystery she had been "reading." She settled back happily as the Library took up the story again.

It wasn't, Julia told herself, as if it really mattered. After all, there wasn't anything for Nancy or anyone else to do, until the geniuses in navigation and computation had figured out where they were. And that would probably take days.

BUT she was wrong. In the wardroom, Commander Broderick was brooding over a bowl of coffee, half watching a bridge game, when Ciccarelli walked in. He looked tired; he didn't even wait for anyone to ask; he volunteered, "Yeah, yeah, we have a position. It isn't good."

"Pretty far?" one of the card players asked wistfully.

Ciccarelli nodded, unsmiling. "Pretty far. We got our fix by triangulating on extra-galactic nebulae, which will give you an idea. I make it—" he glanced at them under his eyebrows—"better than fifteen thousand light-years from Sol."

Ensign Lorch picked up the cards and began to deal them automatically; there wasn't anything much else to do. But his mind was not very completely on bridge.

Fifteen thousand light-years from Sol.

In hyperspace, he thought, it might have been a voyage only of minutes. Outside of the three dimensions in which humans live their normal lives, distances are a matter of cosmic whim. Aldebaran and Betelgeuse, in hyperspace, may almost touch; Luna and the Earth may be infinities apart.

Lorch, staring unseeing at his cards, licked his lips. They had cruised around in hyperspace for a few hours of actual "jump" time before the meteorite had struck. And they had found themselves perhaps a thousand light-years from Earth, perhaps less. They had backtracked moment for moment, as well as they could figure, the same course—and their new position was a dozen times as far.

That was the nature of hyperspace. Line A-B in Newton's universe might be more than line A-B in Riemann's, or it might be less, but it was never the same. And the distances, Lorch thought cloudily, might not even be commutative; A-B plus B-C might not be, probably was not, the same as B-C plus A-B. That was why the Atlas, with his infinite stored checkpoints and positions, had a place on the bridge . . .

"Bid, for God's sake," someone was saying impatiently.

Lorch shook himself. "I'm sorry," he said, focusing on his cards. "Say, isn't it getting hot?"

Nobody answered.

They wouldn't, thought Commander Broderick, lowering into his bowl of cold coffee. Hot? Sure it's getting hot. Not starvation, not thirst, not suffocation—heat. That was the spaceman's enemy, that was what would kill them all.

EVERY time one of the crew drew a breath, carbon in his body oxidized and gave off heat. Every time the rocket jets blasted, heat seeped from the tubes into the frame of the ship. Every time the Diesels that drove the nucleophoretic generators coughed and spun, or the cooks fried an egg, or a spaceman lit a cigarette, there was heat.

Take a hot poker, Broderick suggested meditatively to himself. You can watch it glow red and lose heat that way—that is radiation. You can wave it in the air and let the breeze carry the heat away—that is convection. Or you can quench it in a bucket of oil—and that is conduction. And those are the only ways there are, in Newton's space or Riemann's, of taking heat from one body and giving it to another. And in vacuum, the latter two did not operate, for lack of matter to operate with.

Radiation, thought Broderick, radiation would work. A pity we're not red hot.

If they had been at a tempera-

ture of a thousand degrees, they would have cooled quite rapidly. But at a temperature of perhaps 25° Centigrade, average through *Terra II's* hull, radiation was minute. The loss through radiation was more, much more, than made up through internal heat sources, and so the heat of the ship, hour by hour, climbed.

It had been a long time, Broderick remembered, since he had heard the hiss of expanding air. That was how one coped with heat. From the pressurized parts of the ship, valve off air, the expansion cools, the cooling takes heat from the rest of the ship. Replace the air from the high-pressure tanks, and there's more than enough air in the tanks for any imaginable hyperspace voyage, since none can conceivably last more than a few weeks—and that's that.

"Sir," a voice said, and Broderick realized that the voice had said it before. It was a messenger, saluting respectfully.

"What is it?" he growled.

"Surgeon Mate Conboy," the messenger recited crisply, "asks if you can step down to the sick-bay. Lieutenant Groden is cutting up."

"All right, all right," said Broderick, and waved the messenger away. Groden, he thought, what's the use of worrying about Groden? He'll cook as well as any of us, on this handsomely adventurous hyperspace cruise that cannot conceivably last more than a few weeks.

"You trumped my trick!" howled Ensign Lorch's partner as the surgeon was leaving. Lorch blinked and stared.

"Sorry," he said automatically, then bent and looked closer. "I've only got two cards," he said. "Why does the dummy still have five?"

III

RECORDER Mate Eklund took it as a joke. She looked at herself in the mirror and told her friend Julia, "I think it's quite nice. I don't see why we don't do it all the time."

"You've got the figure for it," Julia said glumly, comparing her own dumpy silhouette with the other girl's. These issue-bathing suits weren't particularly flattering either, she told herself resentfully, knowing in her heart that the fabric had never been loomed to flatter her figure the way it did Nancy Eklund's. "Bathing suits," she said irritatedly. "Oh, why did I ever sign on for this?"

Recorder Mate Eklund patted her arm and jauntily stepped out into the corridor. The male members of the crew were wearing trunks by now, too. She felt more as though she were at some rather crowded beach than aboard *Terra II*. Except that it was so *hot*.

Not only had the uniform of the day been changed to the bare minimum, but there had been other changes in the ship's routine. No more spinning the ship for gravity, for instance. The magnetic-soled shoes were issued for everyone now, because spinning the ship took rocket power, and rocket power meant more heat that they couldn't get rid of. The magnet shoes were all right, but it did take a certain amount of concentration to remember heel-and-toe-and-lean, heel-and-toe-and-lean, in a sort of bent-over half trot like the one that Groucho Marx had once, long before Nancy's time, made famous.

She loped crouching into the Captain's quarters, saluted and took her place. It *was* getting a little wearisome, she thought detachedly. Everything anybody said, it seemed, they wanted recorded in her brain, and nobody ever seemed to take a breath without demanding some part of the stored knowledge recited back to him. Still, when she was recording she was, in effect, asleep; she woke up slightly refreshed, though there were some confusing dreams.

She wondered absently, for a moment, just what she *did* know, in the part of her mind where the records were kept, the part that was available only to outsiders on presentation of the cue words, and never to her.

But by then the other officers had arrived, and the Captain snapped, "*Records*," and she slumped back. Not quite all the way back—just enough so that the natural tensions in the great muscles of the back and thighs reached a point of equilibrium—and, in the non-gravity of the still ship, her sleeping body, moored by the magnets at the feet, floated like Mahomet's Tomb above the chair.

Ensign Lorch felt the Captain's eyes on him and hastily looked away from the Library. Good-looking kid, though, he thought; this strip-down business had its advantages. Too bad the other women in the crew weren't more like her.

THE meeting lasted an hour by the chronometer, as had each meeting of each of the previous eleven days. And it accomplished as much as its eleven predecessors.

"Summing up, then," the Captain said savagely. "One, we can't jump home because we don't know the way; two, we can't jet home through normal space because we don't have the fuel or air; three, we can't stay where we

are because we'll roast. Is that it?"

The Exec said, "That's it, sir. We might set down on another planet, though."

"A planet nearby?" The Captain thought that over. "What about it, Ciccarelli?"

The navigator shrugged. "If we can find one, sir. I'd say the chances were poor. We've got very little in the way of fuel reserve. Every jump uses up a little, and—well, if we come out of a jump within, let's say, a tenth of a light-year of a habitable planet, pretty nearly at relative rest to it, we might be able to make it. We've got maybe one chance in a thousand of that."

Commander Broderick said, "Sir, this is just a wild notion, but suppose we did one of those things they're always doing in the movies, you know? Freeze the whole ship's crew in suspended animation. I believe I could manage something like that out of the medical supplies, if we could only bring the temperature low enough—"

"That's just what we *can't* do," said the Captain.

"Yes, sir," Broderick agreed. "But if we did that, we could valve off a lot of air—maybe enough to cool the ship. Nobody would be breathing, you see. And we could rig up some sort of alarm for when we got there. Wouldn't matter if it was years—even centuries; there would be a vacuum, and no specimen deterioration—I mean, nothing happening to us."

Ciccarelli said mulishly, "Impossible. It's the question of relative rest again. We haven't got enough fuel to mess around. Suppose we found Sol, and pointed right for it. By the time we got there, where would it be? And how fast would it be going, in what direction? Maybe you can tell. I can't."

BRODERICK crouched disconsolately back into his sickbay, and the enlisted man he'd left behind looked up in relief. "It's Groden, sir," he said at once. "He's been acting up."

Ensign Lorch, behind Broderick, hesitated in the doorway. "Acting up?" demanded Broderick.

"Yes, sir. I gave him another needle, but it didn't take effect. I guess it was delirium, sir. Took three ampoules—"

The voices trailed off as they went inside. Lorch made himself comfortable—not an easy job in non-gravity, that is if you were a commissioned officer and concerned about smart appearance.

The two medics were gone for a long time, and when Commander Broderick came out again he looked worried. "Sorry, Lorch," he apologized. He felt the pressure-pot of coffee on the little stove and made a face. "Want some?"

Lorch shook his head. "Too much trouble to drink."

"Don't blame you." But Broderick carefully coaxed a couple of ounces of the stuff into a transparent plastic bulb, teased sugar and cream in after it, spun the bulb with his thumb over the opening to stir it, took a sip. "I don't like it," he brooded over his coffee. "Groden's working up real damage, the kind I can't handle."

Lorch asked curiously, "What kind is that?"

"Inside his head. I had to tell him that his sight was gone, unless we can get to an eye bank within ten days. The optic nerves, Lorch—you can patch in an eye, but once the nerve has degenerated you can't replace it. And he took it hard."

"Yelled and cut up?"

"Worse than that," said Broderick. "He didn't say a word. Now, I *know* that man's in pain; the scars around his eyes are pretty bad. I gave him a couple of pills to knock out the nerve centers, but Conboy found them under his pillow. He wouldn't take them, and he wouldn't make a sound—until he fell asleep, and then he damn near woke up the ship. Conboy must have given him fifty ampoules by now—too much of the stuff. But we can't have him screaming. He's punishing himself, Lorch."

"For what?"

"Who knows for what? If I could put him through an E.E.S., I might be able to find out. But how can you run an electroencephaloscope on a tub like this? I'm lucky they let me have an X-ray."

Lorch said, perhaps a touch too drily, "What did doctors do before they had those gadgets? Shoot the patients?"

It made Broderick look at him thoughtfully. "No," he said after a second. "Of course not. With luck, I could run a verbal analysis on him, and I might pick some of the key stuff out of the sludge in, oh, four or five months. That's what they did before they had the E.E.S. And now let's get busy, mister."

The two of them worked over an inventory of Broderick's medicine chest, because even though the idea of putting the whole ship's crew in suspended animation was ridiculous and impossible and contra-regs besides—what else was there?

And it kept getting hotter.

EVEN Groden felt it.

He called reasonably to whoever was near, "Please do what I ask. Put things back the way

they were, please. Please do it!" He said it many times, many different ways. But his tongue was fat black velvet and his mouth an enormous cave; he couldn't feel the words, couldn't feel his tongue against his cheeks or teeth. That was the needles they kept sticking him with, he told himself. "Please," he said, "no more needles."

But he wasn't getting through.

Groden relaxed. He forced himself to relax, and it wasn't easy. His body was all wrong; it hurt in places, and felt nothing in places, and—were those feelings at his waist and shoulders and legs the touch of restraining belts? He couldn't tell.

He was lying on his back, he was pretty sure. At least, the voices seemed to come from points in the plane of his body, as well as he could locate them. But if he was lying on his back, he asked himself, why didn't he feel pressure on his back? Or pressure anywhere? Could the ship be in free-fall — all this length of time? Impossible, he told himself.

He went back to relaxing.

The thing was to keep from panic. If you were physically relaxed, you couldn't panic. That was what they had taught at the Academy, and it was true. Only they hadn't taught the converse, he thought bitterly; they hadn't said that when you were in panic it was impossible to relax.

No. That's not the way to go about it, he told himself. Relax. Occupy your mind with—with—well, occupy your mind with *something*. Take inventory, for instance.

One, it's hot. There was no doubt of that.

Two, something was pressing against his body at various points. It *felt* like restraining belts.

Three, voices came and talked to him. Damned dirty lying voices that— He caught himself just in time.

Four, he said to himself, *four*, somebody keeps sticking needles into me.

It was the needles, he thought wretchedly, that made everything else so bad. Maybe the needles *caused* everything else. With craven hope he told himself: Sure, the needles; they're sticking me full of drugs; naturally I'm having delusions. Who wouldn't? I'm lucky if I don't turn into a hophead if I get out of this—

When I get out of this, he corrected himself, whimpering.

He wondered whether he was crying.

Of course, if those lying voices were, by some chance, *not* lying, then he couldn't be crying. Because he wouldn't have any eyes to cry with. And, he told himself reasonably, there wasn't much doubt that the voices were plausible. He had been injured somewhere around his eyes; he had felt the pain, and it was too intense and specific to be unreal. That was in the old days—how long ago they were, he could not begin to imagine—when there had been only a few needles now and then, and even if he did have a little trouble moving and talking, he was still in perfect possession of his faculties.

All right, he thought. So I was injured around the eyes.

But the rest—that was a damned lie. He had even believed if for a while—when the Broderick-voice said, with hypocritical sympathy, that he wouldn't be able to see anything, ever, unless they got him new corpse's eyes out of an eye bank on Earth. It had been a blow, but he believed it. Until, he reminded himself triumphantly, he had *seen!* Seen as clearly as he knew the voices were lying, that was when he began to suspect the existence of the whole horrible senseless plot.

"No!" he screamed. "Please, please—no!" But they couldn't be hearing him, because they were going right on with another needle; he could feel it. Furiously he fought to pull back the alien arm, make the marble lips move, the black velvet tongue speak, "*Please*—"

ON the bridge, the Captain was staring fixedly at the alien stars. It was a measure of his state of mind that he was on the bridge at all, at a time when the ship was going nowhere and there was nothing to be done beyond the routine.

He leaned forward in his chair, jerking free the little magnets sewn into the waist of his trunks, and walked heel-and-toe across the bridge. The little Recorder Mate, Eklund or whatever her name was, was standing humbly in a corner, waiting for him to tell her why he had sent for her. But, the Captain confessed to himself, the trouble was he didn't exactly know why himself. And, after all, why should he? It was so damned hot—

Belay that kind of talk, he told himself. He said: "Eklund! Index." The girl's eyes closed like the snapping of a shutter.

"Take over," the Captain ordered the Exec. "Run her through the Riemannian configurations again. We'll get every bit of dope she has." And they would, he knew. Because they had already.

And none of it helped.

IV

IT was a good thing, Ensign Lorch told himself, sweating, that spaceships were not painted. Otherwise he would surely have

been set to commanding a crew chipping paint.

Terra II being welded of unpainted metal, the color a part of the alloy itself, his crew was defluffing the filter traps in the air circulators. It was a job for idiots, planned by morons; it took six men five hours to disassemble the air trunks and the junction boxes, five minutes to blow out the collected fluff on the static accumulators, five hours to put them back together again. There was an alternative method, which involved burning them clean with a high-voltage arc; that took one man slightly under three seconds. But that, the Exec had decreed, meant heat.

And *heat* was the enemy.

Of course, there was still a third alternative, which was to leave the fluff in the filter traps undisturbed. This would have generated no heat at all. But it also would have taken no time and occupied no personnel, which were decisive counts against it in the eyes of the Exec. A little fluff in the filters would make no conceivable difference to the operation of the ship, but idle men might make a very great difference indeed.

"Hurry it up," growled Ensign Lorch. The men didn't even look at him. Lorch looked around him self-consciously. As an officer, he had made inspection tours in the enlisted women's quarters before, but he couldn't help feeling out of place and slightly apprehensive.

That girl, the Recorder Mate—Eklund was her name—was droning all the parts of *Cyrano de Bergerac* to an audience in the far end of the lounge, and parts of Cyrano's farewell to Roxanne kept mixing in with Lorch's thoughts.

It didn't matter; he wasn't thinking to any purpose, anyhow. Neither he nor anyone else on *Terra II,* he told himself bitterly. Fifteen thousand light-years. The light that came to them from Sol—how weak and faint!—had been bright summer sunlight beating down on the skin tents of Neolithic Man creeping northward after the retreating ice. And the light from the nearest stars beyond *Terra II's* skin, contrariwise, would fall on an Earth inconceivably advanced, a planet of mental Titans . . .

"Mister Lorch," someone was repeating plaintively.

The ensign shook himself and focused on the spaceman wavering before him. "Eh?"

"We're done," the man repeated. "It's all put together again. The filter traps," he explained.

"Oh," said Ensign Lorch. He glanced self-consciously at the women at the far end of the lounge, but they were absorbed in Rostand's love story. There was a murmur of gossip from them—"so all at once I knew there was somebody *looking* at me. Well, I called the duty officer and we searched, but—"

Ensign Lorch cleared his throat. "Well done," he said absently. "Dismissed." He turned his back on the detail and propelled himself down the passageway toward the sickbay.

IF he went back to the bridge, the Old Man would find work for him; if he went to the wardroom, the Exec would find an excuse to send him to the Old Man. And his own quarters were horribly, stifling hot.

He accosted the Ship's Surgeon and demanded, "How long are we expected to live in this heat?"

Commander Broderick said irritably, "How should I know? You don't die of the heat, that's sure. There are other things that will come first—suffocation, thirst, maybe even starvation."

Lorch looked thoughtful at the medical officer. Red-eyed, his face lined with worry and weariness, Broderick was showing strain. Through his scanty shorts, you could see the fishbelly whiteness of his skin; it was old man's skin, and Broderick, for all of his passing the annual fitness exam, was getting on toward being an old man.

Lorch said more gently, "I guess you're getting a rough time all around."

"Good Lord, am I!" the surgeon snapped. "Half the ship's complement has been in here today—little fiddling things like prickly heat and dizzy spells. Dizzy spells! How the devil can anyone *not* have dizzy spells? The women's quarters have practically a regular courier service. If it isn't anti-perspirants, it's salt tablets; if it isn't salt tablets, it's alcohol from the ship's store for rubdowns." He passed his hand shakily over his eyes. "Then," he said, "to top it all off, there's him." He pointed to the inner chamber of the sickbay. Lorch, listening, could hear the blinded Groden's rasping breath.

There was a shrill whistle from the speaking tube, then, tinnily, a voice from the bridge. "Commander Broderick! Captain requests you report to the bridge at once."

The Surgeon blinked and swore. "How the devil am I supposed to do that?" he demanded. "Two of my crewmen are out with heat prostration, and the other two were working all night. All right, I go up to the bridge. Suppose there's some trouble? Suppose Groden starts acting up again?" He stared irresolutely at the speaking tube.

Lorch said thoughtfully, "Say, Commander, could I keep an eye on him for you?"

It was a fine idea. Broderick took off for the bridge and Lorch, hastily briefed on the simple task of sticking a new needle in Groden's arm if he showed any signs of trouble, bade him a careful good-by and waited until he was well out of sight before, whistling, he knelt before the cabinet of emergency medical supplies.

Broderick had given him an idea. And, he told himself blissfully, moments later, it had been a good one. Alcohol rub! Now why hadn't he thought of that himself?

He hardly noticed that Groden's heavy breathing had changed pitch and character. It almost formed words now.

ON the bridge, the Captain was briefing the ship's officers—all but Groden, in the sickbay, and Lorch, who, the Captain had agreed, was easily enough spared to watch after Groden—on what in his mind he called Project Desperation. It didn't take much briefing, because it was the only thing left for them to do and every man on the ship knew it.

"We have," the Captain said precisely, "margin for just under forty minutes of rocket blast at standard thrust. That will bring our overall temperature up to 60°, give or take a degree, according to Engineering's best guess. And that's the maximum the human body can stand—that's right, Broderick?"

The Surgeon quickly translated into the Fahrenheit scale; a hundred and forty degrees or so.

"That's right, sir," he said. "If we can stand that much," he added reluctantly after a moment. "It hits that on Earth in a couple of places—around the Dead Sea, Aden, places like that. But it isn't sustained heat; it drops considerably after dark."

The Captain nodded somberly. "We'll hope," he said, "that we'll find ourselves out of this before we hit sixty degrees. If we don't —well, at least we won't starve or suffocate. You understand, gentlemen, that the odds are against us. I suggested to Lieutenant Ciccarelli that it was a million-to-one shot. He said I was an optimist. But one chance in a million, or a billion, or whatever the number may be, is better than no chance at all. Do you all agree?"

There was no answer. The Captain went on, "Before we jump, I presume no one has a better idea?" No one had. "Thank you. Then, gentlemen, if you will assume your stations, we'll get down to business. Stand by to jump."

The Captain took his place with an air of benign detachment. It wasn't a Captain's job to take the conn of a ship in a perfectly routine maneuver. He watched approvingly as the Exec put the ship on alert, then on stand-by, then went through the checklist that culminated in the "jump" into hyperspace.

The Captain was a model of placid, observant command officership, but behind the placid face, the agitated mind was churning out awful calculations.

Consider the Galaxy, he was thinking to himself; a hundred thousand light-years broad, perhaps forty thousand through its axis. Call it a lens-shaped figure with a volume of three hundred trillion light-years. Say that their cruising radius, in normal space, was within a volume of one light-year; that meant that the chances of their coming out, by accident, within cruising distance of Earth was—not one in a million, or one in a hundred million, or one in a billion . . .

It was one chance in three hundred trillion.

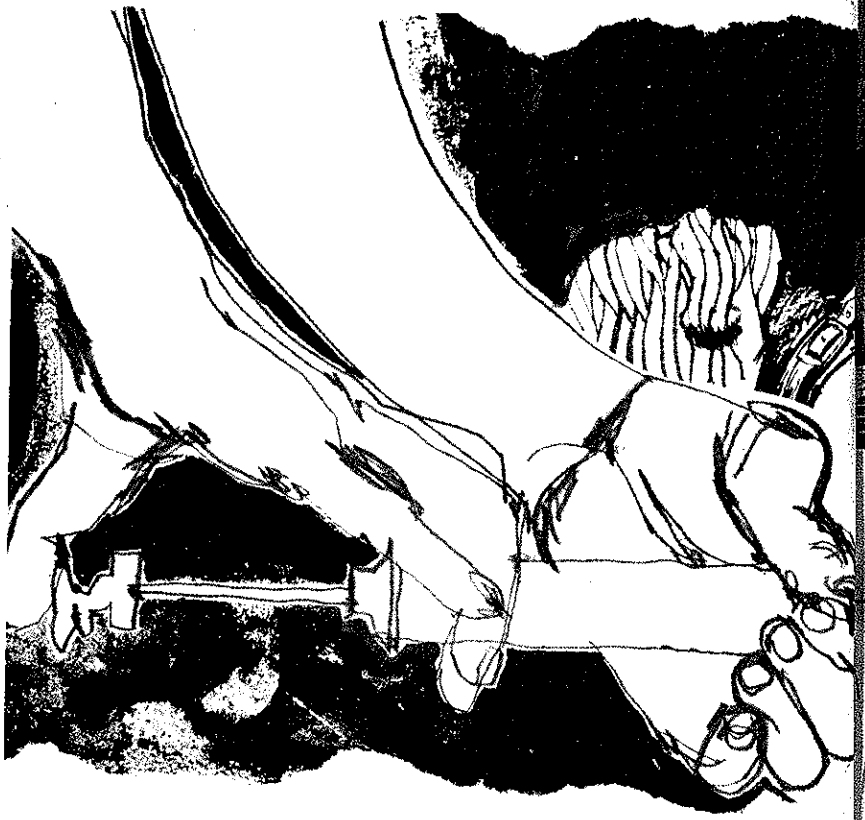
The Captain juggled the numbers comfortably enough in his mind. They were absolutely meaningless, far too big to be comprehended or feared.

THERE it was, the beautiful Master Pattern.

Groden lay tense and fearful, seeing it. It had been a long time since the last needle; by the only clock he owned, his heartbeat, it had been more than two hours since he discovered that he could move his lips and his fingers again. He had feverishly wondered why; and had dared not speak or move after the first trials for fear of bringing the needle again. But now he knew.

There was the Master Pattern. He scanned it slowly in every part. There was the giant star-cluster of Hercules; and there the bridge of *Terra II;* there was the fat red disc of Betelgeuse; and there the shower room of the enlisted women's quarters. He took in the ordered ranks of the constellations as easily as he noted that Broderick was gone from the sickbay, and in his place the young ensign, Lorch, was clinging with harried expression to a stanchion. They were in hyperspace. Broderick was on the bridge. Lorch had been left in charge, and it had not occurred to him, since his patient had been so carefully quiet, to administer another needle.

Groden carefully moved his hands, and found that they would do what he wanted. He was getting the hang of—well, it was not seeing, exactly, he confessed to himself. It was like being alone on a starless night, in the middle of a dark wood. It took time to



get used to the darkness, but by and by shapes would begin to make themselves known.

It was not the same thing; this was no mere matter of the expanding pupil of the eye; but the effect was something the same. But explain it or not, he was becoming able to use it; each time the beautiful vision was more complete, and therefore more beautiful.

He found the straps that bound him, and unbuckled them.

On the bridge, he "saw," the jump at random was nearing its end. It would be only a matter of minutes before they were back in normal space, and he was blind again.

In the outer room of the sick-bay, Ensign Lorch was staring dismally at the hallucinations of hyperspace. It was almost certain, thought Groden to himself, that if Lorch was so fortunate as to see him at all, he would pass off the sight as another of the lies light told. The important thing was sound; he must not make a noise.

He crept through the door, carefully holding to the guide rails. Broderick had been right about one thing, though, he admitted—the pain. The wreck of his eyes no longer seemed as important, with the wonderful things hyperspace's cloudless perception brought to him, but the shattered bone and tissue and nerve ends *hurt*.

Algol's dark primary occluded the radiant star for a second and confused him; they were moving faster than he had thought. He hastily scanned the Master Plan again, fearful for a second. But

there was Sol and its family of planets, and there was Earth. *Terra II* might be lost, but Lieutenant Groden was not, and if only he could get to the bridge. . .

He scanned the bridge. It was later than he thought. He felt the vibrations in the floor as he realized that the jump was at an end. Panicked, he hesitated.

Blackness again, and no more stars.

He stood there, incredibly desolate, and the pain was suddenly more than he could bear.

And from behind him he heard a startled yell, Lorch's voice: "Hey, Groden! Come back here! What the devil are you doing out in the passage?"

It was the last straw. Groden had no tear ducts left with which to weep, but he did the best he could.

BRODERICK worked over the girl, Eklund, for a moment, and brought her to. She stared at him uncomprehendingly for a moment, but she was all right. As all right, he thought, as anyone on *Terra II* had any chance to be.

"Plain heat prostration," he reported to the Captain. "It's been a pretty rough job for her, trying to keep on top of all this."

The Captain nodded unemotionally. "Well, Ciccarelli?" he demanded.

The Navigator ran his hands through his hair. "No position, sir," he said despondently. "Maybe if I ran down the third and fourth magnitude stars—"

"Don't bother," the Captain said. "If we aren't within a light-year of Sol, we're too far to do us any good. At your convenience, gentlemen, we'll take another jump."

The Exec nodded wearily and opened his mouth to give the order, but Broderick protested, "Sir, we'll all be falling over if we don't take a break. The temperature's past forty-five now. The only way to handle it is frequent rests and plenty of liquids."

"Ten minutes be enough?"

The surgeon hesitated. Then he shrugged. "Why not? No sense worrying about long-term effects just now, is there?"

"There is not," said the Captain. "Make it so," he ordered the Exec.

The Captain half-closed his eyes, fanning himself mechanically. When the runner from the wardroom brought him his plastic globe of fruit juices he accepted it and began to sip, but he wasn't paying very much attention. He had the figures on the tip of his tongue: The first blind jump in Project Desperation had cost them sixteen minutes of rocket time. He could be a little more conservative with the next one—maybe use only ten minutes. That way he could squeeze out at least one more full-length, or nearly full-length, jump; and then one last truly desperate try, not more than a minute or two. And if that didn't work, they were cooked.

Literally, he told himself wryly.

In fact, he continued, counting up the entries in red ink on their ledger, they were just about out of luck now. For even if their next jump took them within cruising distance of Earth, there was still the time factor to be considered. They had left only twenty-four minutes of jet time before *Terra II's* hull temperature passed the critical sixty-degree mark.

True, he had maintained some slight reserve in that not *all* their expansible gas had been used. There remained a certain amount in the compressed tanks. And even beyond that, it would be possible to valve off some of the ship's ambient air itself, dropping the pressure to, say, ten pounds to the square inch or even less.

That *might* give them maneuvering time in normal space—provided they were God-blessed enough to come out of one of the three remaining jumps within range of Earth, provided all the angels of heaven were helping them. . .

Which, it was clear, he told himself, they weren't.

"Sir," said Commander Broderick's voice, "I think you can proceed now."

The Captain opened his eyes. "Thank you," he said gravely and nodded to the Exec. It was a quick job by now. The kerosene lamps were already lit, the main electric circuits already cut; it was only a matter of double-checking and of getting the nucleophoretic generators up to speed.

The Captain observed the routine attentively. It did not matter that the fitness reports for which he was taking mental notes might never be written. It was a Captain's job to make his evaluations all the same.

"Stand by to jump!" called the Exec, and the talker repeated it into the tubes. Down in the generator room, the jumpmen listened for the command. It came; they heaved on the enormous manual clutches.

And *Terra II* slipped into Riemannian space once more.

THE stars whirled before the Captain's eyes and became geometrical figures in prismatic colors. The slight, worn figure of the Library, the girl named Eklund, ballooned and wavered and seemed to float around the bridge. The Captain looked on

with composure; he was used to the illusions of hyperspace. Even —almost—he understood them. From the girl's vast stored knowledge, he had learned of the connection between electric potential and the three-dimensional matrix.

Light and electrons; In hyperspace, they lied.

Matter was still matter, he thought; the strange lights beyond the viewing pane were stars. And the subtler flow within his body was dependable enough, for he could hear as reliably as ever and if he touched something hot, the nerve ends would scream *Burn!* to his brain. But the messenger between the stars and the brain—the photons and electrons that conveyed the image—were aberrants; they followed curious Riemannian courses, and no brain bound by the strictures of three dimensions could sort them out.

Just as now, thought the Captain with detached amusement, I seem to be seeing old Groden here on the bridge. Ridiculous, but as plain as life. If I didn't know he was asleep in the sickbay, I'd swear it was he.

"Captain! Captain!" Ensign Lorch's voice penetrated over the metronome - cadenced commands of the Exec and the bustling noises of the bridge.

The Captain stared wonderingly at the phantasms of light. "Ensign Lorch?" he demanded. "But—"

"Yes, sir! I'm really here and so is Groden." Lorch's voice went on as the Captain peered into the chaos of shifting images. Lorch himself wasn't visible — unless that sea-green inverted monstrosity with a head of fire was Lorch. But the voice was Lorch's voice, and the figure of Groden, complete with the white wrappings over the eyes, was shadowy but real. And the voices were saying —astonishing things.

"You mean," said the Captain at last, "that *Groden* can pilot us home?"

"That," said Groden, in the first confident voice he had been able to use in days, "is just what he means."

V

BLIND man's buff. And what better player can there be than a blind man?

Lieutenant Groden, eyeless and far-seeing, stood by the Exec's left hand and clipped out courses and directions. The Exec marveled, and stared unbelievingly at the fantastic patterns outside the bridge, and followed orders.

And presently Groden gave the order to stop all jets and drop back into normal space. In a moment, he was blind again—

and the rest of the bridge complement found themselves staring at a reddish sun with a family of five planets, two of them Earthlike and green.

"That's not Sol!" barked the Captain.

"No," said Groden wearily, "but it's a place to land and cool the ship and replenish our air. You ran us close to the danger line, Captain."

Terra II came whistling down onto a broad, sandy plain, and lay quiet, its jet tubes smoking, while the Planetology section put out its feelers and reported:

"Temperature, pressure, atmospheric analysis and radiation spectrum—all Earth normal. No poisons or biotic agents apparent on gross examination."

"There won't be any on closer examination either," said Groden. "This planet's clean, Captain." He stood hanging on to a stanchion, pressed down by the gravity of the world he had found for them.

The Captain looked at him thoughtfully for a moment, but there were more important things to attend to.

"Bleed in two pounds," ordered the Captain and the Duty Officer saluted and issued orders into the speaking tube.

They had run close to the danger line, indeed; the ambient pressure inside *Terra II*'s hull had been bled down to a scant ten pounds, in order to use as much cooling effect from releasing gas as possible. Whether it was clean or not, no man could step out onto the surface of the new planet until the pressures had been brought back to normal.

They stood at the view panel looking out on the world. They were near its equator, but the temperature was cool by Earth standards. Before them was a broad, gentle sea; behind them, a rim of green-clad hills.

The Captain made ready to send his first landing party onto a new and livable planet.

THE scouting parties were back and the Captain, for once, was smiling. "Wonderful!" he exulted. "A perfect planet for colonization—and we owe it all to you, Groden."

"That's right," said Groden. He was lying down on a wardroom bench—Broderick's orders. Broderick had wanted to put him under sedation again, in fact, but that had brought Groden too close to mutiny.

The Captain glanced at his Navigator. The swathed bandages hid Groden's expression, and after a moment the Captain decided to overlook the remark.

He went on, "It's a medal for you. You deserve it, Groden."

"He'll need it, sir," said Com-

mander Broderick. "There won't be any new eyes for Lieutenant Groden." He looked old and sick and defeated. "The optic nerves are too far gone. New eyes wouldn't help now; there's nothing that would help. He'll never have eyes again."

"Sure," said Groden casually. "I knew it before I brought you here, Captain."

The Captain frowned uncomprehendingly, but Broderick caught the meaning in an instant. "You mean you could have brought us back to Earth?" he demanded.

"In two jumps," Groden told him easily.

"Then why didn't you?" snapped the Captain. "I have a responsibility to my crew—I can't let a man go blind because of phony heroics!"

Groden swung him feet down, sat up. "Who's a hero? I just didn't want to trade what I have now for what I used to have, that's all."

"Meaning what?" asked Broderick.

"It's more than seeing. Want to know how many Sol-type systems there are within five thousand light-years of here? I can tell you. Want to know what the Universe looks like in hyperspace? I can tell you that, too, only I can't describe it. It makes *sense*, Captain! The whole thing is as orderly and chartable as our own space. And I could see it, all of it. And you offer me *eyes!*"

"But why don't I see it, Groden?" the Captain puzzledly wanted to know. "Surely we've all closed our eyes for a moment in hyperspace—why didn't we see it then?"

"Sleep and death are alike, but they're not the same. Neither is closing your eyes and being blind. I'm blind in normal space; you're blind in hyperspace—that isn't much of an answer, but the medics will work it out."

The Surgeon looked piercingly at Groden's bandaged face. "Then the odds are that *any* blind person can see in hyperspace?"

"I think so," Groden agreed. "In fact, I'm practically certain."

"Then," said the Captain, "it's our duty to return to Earth and let them know. They can equip each mapmaking ship with a blind person."

Groden gave his head a shake. "Plenty of time for that, Skipper. We have a quadrant of hyperspace to chart. With me on hand to 'see' during the jumps, we'll finish up fast. Then we can go back and tell them. But I think we should get on with the job we've been assigned."

"Right," said the Captain after a pause. "We'll bring the ship to stand-by for takeoff."

THE rockets thundered and *Terra II* split the atmosphere on its way to deeper space.

As soon as they were clear, the ship readied for the jump and the Captain said, "Good luck, Groden. It's all yours—give us our course."

Groden felt the quiver of the generators, far below, and at once the Universe lay spread before him.

No more darkness, no blind fumblings. An end to basket-weaving and the dreary time-passing fingering of Braille for Earth's incurable blind. They would be the eyes of the proud new hyperspace fleet that was yet to come!

"It's all yours, Groden," the Captain repeated.

Groden cleared his throat, issued his course vectors.

Captain, you don't know how right you are, he thought. Only it won't be just mine—it'll be the blind leading the sighted!

Now there, he chuckled, was a switch. But he'd have to wait until he was back on Earth, among the blind, for it to be appreciated.

—FREDERIK POHL